C/015/035 Incoming

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EarthFax

August 24, 2016

Mr. Daron Haddock
Coal Program Manager
Utah Division of Oil, Gas and Mining
1594 West North Temple
Suite 1210
Salt Lake City, UT 84114-5801

RECEIVED
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Subject: BRC Wellington, Bowie Waste Rock Site, C/015/0035
Coal Recovery Permit Application Clean Copy Submittal,
DOGM Task ID #4966

Dear Daron:

On behalf of BRC Wellington, LLC I am pleased to submit two clean copies of the permit application for the Bowie Waste Rock Site (C/015/0035). Please send one of these copies to BRC Wellington once you have stamped it as incorporated into your files.

This submittal, which is made in response to the letter from John Baza to Kyle Edwards dated 11 Aug 2016, includes a copy of the signed C1 Form as well as a copy of the C2 Form. An updated copy of the facility's certificate of insurance is provided in Appendix 1-2 of the permit application. The reclamation bond and reclamation agreement will be provided to you under separate cover.

Please feel free to contact me (801-561-1555) or Kyle Edwards (435-613-1631) if you have any questions regarding this submittal. Thank you for your assistance in approving this application.

Sincerely,

Richard B. White, P.E.
President
EarthFax Engineering Group, LLC

Enclosure

cc: Kyle Edwards (BRC Wellington)
Justin Thompson (Bowie Refined Coal)

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☐ New Permit ☒ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: BRC Wellington, LLC
Mine: Wellington Dry Coal Cleaning Facility **Permit Number:** C/015/0035
Title: Coal recovery from the existing Deer Creek waste rock pile (now known as the Bowie Waste Rock Site)
Description, Include reason for application and timing required to implement:
Permit application to recover coal from the existing Deer Creek waste rock pile - CLEAN COPY

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☐ Yes ☒ No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☒ Yes ☐ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☒ Yes ☐ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☒ Yes ☐ No 15. Does the application require or include soil removal, storage or placement?
☒ Yes ☐ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☒ Yes ☐ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☒ Yes ☐ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☒ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☒ Yes ☐ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Steve Rickmeier
Print Name

Sign Name, Position, Date: Principal 8-24-16

Subscribed and sworn to before me this 24th day of August, 2016

Michelle A Wilson
Notary Public

My commission Expires: 9-18, 2018

Attest: State of Kentucky } ss:
County of Jefferson

MICHELLE A WILSON NOTARY PUBLIC STATE AT LARGE, KY

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Form DOGM- C1 (Revised March 12, 2002)

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: BRC Wellington, LLC
Mine: Wellington Dry-Coal Cleaning Facility **Permit Number:** C/015/0035
Title: Permi application for coal recovery from the existing Deer Creek waste rock pile (now known as the Bowie Wate Rock Site) - CLEAN COPY, Task ID #4966

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Chapter 1 text, tables, figure, and appendices
☐ Add	☒ Replace	☐ Remove	Chapter 2 text, figure, and appendices
☐ Add	☒ Replace	☐ Remove	Chapter 3 text, table, figures, and appendices
☐ Add	☐ Replace	☐ Remove	Chapter 4 text and appendices
☐ Add	☒ Replace	☐ Remove	Chapter 5 text, table, figures, and appendices
☐ Add	☒ Replace	☐ Remove	Chapter 6 text, figure, and appendix
☐ Add	☒ Replace	☐ Remove	Chapter 7 text, tables, figures, and appendices
☐ Add	☒ Replace	☐ Remove	Chapter 8 text and appendix
☐ Add	☒ Replace	☐ Remove	Chapter 9 text
☐ Add	☒ Replace	☐ Remove	Cover page and Table of Contents
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	Plate 2-1
☐ Add	☒ Replace	☐ Remove	Plates 3-1 and 3-2
☐ Add	☒ Replace	☐ Remove	Plates 5-1 through 55
☐ Add	☒ Replace	☐ Remove	Plates 7-1 and 7-2
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.

Clean copy submittal in accordance wth DOGM letter dated August 11, 2016.

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Permit Application for Coal Recovery from the Existing Deer Creek Waste Rock Pile

Bowie Waste Rock Site
C/015/0035

BRC Wellington, LLC
Louisville, Kentucky

August 2016

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CHAPTER 1
LEGAL, FINANCIAL, COMPLIANCE, AND RELATED INFORMATION

1.10 Minimum Requirements

1.1.1 Introduction

This chapter provides information regarding ownership and control of the permit area. The compliance status of the operator at other locations is also provided herein. The waste rock pile covered by this application was first permitted for use on September 13, 1988 by the Utah Division of Oil, Gas and Mining (the "Division"). The original permit was issued to Utah Power and Light Company for disposal of waste rock generated at their Deer Creek Mine. The Deer Creek waste rock site (the "Deer Creek site" or the "site") has since been purchased by Bowie Refined Coal LLC ("BRC") for recovery of available coal. The site is located in Sections 5 and 6, Township 17 South, Range 8 East, SLBM, immediately north of State Route 31 approximately 6 miles northwest of Huntington, Utah.

This document has been arranged in the format of the R645-301 regulations. For example, Section 1.10 corresponds to R645-301-110, Section 1.1.1 corresponds to R645-301-111, Section 1.1.2.2 corresponds to R645-301-112.200, etc.

1.1.2 Identification of Interests

BRC Wellington LLC (hereafter referred to as "BRCW") is a subsidiary of DB RC Investments II LLC and an affiliate of Bowie Refined Coal LLC and various subsidiaries of Deutsche Bank, as indicated in Figure 1-1. BRCW is the owner of a dry coal cleaning facility located in Carbon County, Utah. Bowie Refined Coal, LLC ("BRC") is the operator of the facility. Furthermore, BRC is the owner and/or managing member of DB RC Investments I, LLC and DB

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RC Investments II, LLC. The Deutsche Bank affiliates shown on Figure 1-1 (DB AG Cayman Islands Branch and DBAH Capital) are equity investors only with respect to the BRC companies.

1.1.2.1 Business Entity

BRCW and BRC are both limited liability companies. The affiliated Deutsche Bank subsidiaries are also limited liability companies.

1.1.2.2 Applicant and Operator

The applicant and operator for this permit application are:

APPLICANT: BRC Wellington, LLC
6100 Dutchmans Lane, Suite 900
Louisville, KY 40205
Facility Phone: (435) 613-1631
Headquarters Office Phone: (502)584-6022

Payment of abandoned mine land reclamation fees, if any, will be the responsibility of the managing member of BRCW. Inquiries regarding the payment of this fee should be directed to this individual at the mailing address and phone number indicated above. The person currently occupying this position is indicated in Section 1.1.2.3.

OPERATOR: Bowie Refined Coal, LLC
6100 Dutchmans Lane, Suite 900
Louisville, KY 40205
Facility Phone: (435) 613-1631
Headquarters Office Phone: (502)584-6022

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1.1.2.3 Officers and Directors

The directors and officers DB RC Investments I LLC (FEIN 46-1601691), DB RC Investments II LLC (FEIN 46-1613542), and BRCW (FEIN 36-4743889) are:

Name	Title	Date position was assumed
Steve Rickmeier (100% owner)	Managing Member	09/20/2012

The addresses and phone numbers for the officers and directors of DB RC Investments I, LLC, DB RC Investments II, LLC, and BRC are the same as the applicant.

Written correspondence to BRCW or BRC regarding the operations should be addressed to:

Kyle Edwards, Resident Agent
BRC Wellington LLC
1865 West Ridge Road
Wellington, UT 84542
(435)613-1631

The directors and officers of BRC (FEIN 46-0911657) are:

Name	Title	Date position was assumed
Steve Rickmeier (100% owner)	Managing Member	09/20/2012

Mr. Rickmeier's ownership of BRC is divided between Rickmeier Advisors, Inc. (FEIN 36-4483193, owning 45% of BRC) and Rickmeier Partners LP (FEIN 35-2202674, owning 45% of BRC). This individual holds the same position and the same ownership percentage in each of the following companies:

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Bowie Refined Management LLC
BRC Chinook LLC
BRC Pinnacle LLC
BRC Rockcrusher LLC
BRC Greenfuels LLC
BRC Alabama No. 3 LLC
BRC Alabama No. 4 LLC
BRC Alabama No. 5 LLC
BRC Alabama No. 7 LLC

This individual also has partial ownership, through BRC, in DB RC Investments II, LLC, which then owns 100% of BRC Minuteman LLC and BRC Wellington LLC. The organizational structure of BRC is outlined in Figure 1-1.

1.1.2.4 Coal Mining and Reclamation Operation Permit Applications

The following list represents all permits issued to BRC, along with applicable identification numbers of applications or permits:

Permit	Issuing Authority	Status
UPDES Permit (No. UTR000685)	Utah Dept. Environmental Quality, Division of Water Quality	Approved
Approval Order (DAQE# AN2952001-03)	Utah Dept. Environmental Quality, Division of Air Quality	Approved
DAQ NOI Approval (Deer Creek waste rock site)	Utah Dept. Environmental Quality, Division of Air Quality (see Appendix 4-4)	Approved
Certificate of Insurance and Business Authorization	Utah Industrial Development Commission	Approved
Mining and Reclamation Permit (C0070045)	Utah Department of Natural Resources, Division of Oil, Gas and Mining	Approved

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These permits are related to operations conducted by BRC at the Wellington Dry-Coal Cleaning Facility in Wellington, Utah.

Permits held by subsidiary and/or affiliated companies of BRC are indicated in Table 1-1. In addition to the permit that BRC is seeking from the Utah Division of Oil, Gas and Mining for

operations at the Deer Creek site, BRC will also be obtaining a permit from the Utah Division of Air Quality. The sedimentation pond at the Deer Creek site is designed as a total-containment facility (see Section 7.4.2.2 of this application). Therefore, BRC will not be seeking a discharge permit from the Utah Division of Water Quality for operations at the site.

1.1.2.5 Legal or Equitable Owner of the Surface and Mineral Properties to be Mined

BRCW is the legal and equitable owner of the entire 49.05-acre surface parcel included within the permit area (see Appendix 1-1). BRCW's right to enter the property and conduct operations thereon is not the subject of current litigation. There will be no mining at this facility (only recovery of coal from an existing waste rock pile). Thus, the mineral properties will not be affected by the operation. A property ownership map of the permit and adjacent areas is presented as Plate 5-2. No area within the lands to be affected by the facility is under a real estate contract.

1.1.2.6 Owners of Record of Property Contiguous to Proposed Permit Area

The following owners of surface lands are contiguous to the permit boundary:

Utah Power and Light Company
1407 West North Temple
Salt Lake City, Utah 84116

U.S. Department of the Interior
Bureau of Land Management
900 North 700 East
Price, Utah 84501

State of Utah
Utah Division of Forestry, Fire and State Lands
319 North Carbondale Road, Suite D
Price, Utah 84501

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The locations of these lands relative to the permit area are shown on Plate 5-2.

1.1.2.7 MSHA Numbers

The MSHA number for the operation is: 4202398

1.1.2.8 Interest in Contiguous Lands

The applicant neither owns nor controls, directly or indirectly, a legal equitable interest in any lands contiguous to the permit area.

1.1.3 Violation Information

Neither BRCW nor any major stockholder of BRCW having any interest, either legal or equitable, in the Deer Creek site have had a State or Federal mining permit suspended or revoked in the five years preceding the date of submission of this application, or have forfeited a performance bond or similar security deposited in lieu of bond revoked. A summary of Notices of Non-compliance associated with mining, air, or water permits issued to BRCW or related entities during the three year period preceding the submission of this application is provided in Table 1-2.

1.1.4 Right-of-Entry Information

The Deer Creek site is located on lands that are entirely owned by BRCW (see Appendix 1-1). Hence, no other right of entry is required.

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1.1.5 Status of Unsuitability Claims

The permit area is not located within an area that has been designated as unsuitable for mining and reclamation operations, nor is it within an area under study for designation in an administrative proceeding under R645-103-300, R645-103-400, or 30 CFR Part 769.

1.1.6 Permit Term

Operations for recovery of coal from the Deer Creek site will began as soon as required permits are issued for these operations. Termination of operations will be determined by economic and working conditions. The timing of this termination is, therefore, unknown. It is anticipated that the Applicant will operate at the site for a period of less than 5 years. The anticipated total acreage to be affected during operations is less than the 49.05-acre surface parcel included within the permit area.

1.1.7 Insurance and Proof of Publication

A certificate of Insurance issued to BRC is provided in Appendix 1-2. The following announcement was published in the Emery County Progress, a newspaper of general circulation in the Huntington area, from October 6 through October 27, 2015 following notification that the Division had determined that this permit application was complete. Proof of publication of this announcement is provided in Appendix 1-3.

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NOTICE OF PERMIT APPLICATION
BRC WELLINGTON LLC

Notice is hereby given that BRC Wellington LLC, 6100 Dutchmans Lane, Suite 900, Louisville, Kentucky 40205 has submitted an application to the Utah Division of Oil, Gas and Mining (the "Division") to recover coal from the Deer Creek waste rock site located approximately 6 miles northwest of Huntington, Utah. The permit area for this facility is located in Sections 5 and 6, Township 18 S., Range 8 E., SLBM and contains approximately 49.05 acres.

The Division has determined that this application is administratively complete. A copy of the permit application is available for public inspection at the following locations:

Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, UT 84114-5801

Written comments, objections, or a request for an informal conference regarding the above application should be directed to the Division at the above address within the next 30 days.

1.1.8 Filing Fee

The permit filing fee was paid upon submittal of the application.

1.20 Permit Application Format and Contents

The permit application contains clear, concise, current information, in the format of the DOGM regulations.

1.30 Reporting of Technical Data

All technical data submitted in the permit application is accompanied by the names of persons or organizations that collected and analyzed the data. The technical data also contains the dates of collection and analysis of the data, and descriptions of the method used to collect and analyze data, as indicated in subsequent sections of this application. Professionals qualified in the subject planned or directed the technical analyses. These professionals included the following:

- Richard B. White, P.E. – President/Civil and Environmental Engineer, EarthFax Engineering Group, LLC (engineering, soils, hydrology, bonding, alluvial valley floors)
- Patrick Collins, Ph.D. - President, Mt. Nebo Scientific, Inc. (vegetation)
- Val Payne - Wildlife Biologist, Utah Power and Light Company (wildlife)

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1.40 Maps and Plans

The maps submitted in this permit application comply with the format required by the regulations. The permit area was developed prior to the initial submittal of this permit application in February 2015.

The permit area boundary shown on the maps submitted in this permit application is an approximate representation of that boundary. A more complete description of that boundary is provided in Appendix 1-1 as follows:

Beginning at the Northwest corner of Section 6, Township 17 South, Range 8 East, SLB&M, and running thence S 89°52'00" W, 1272.00 feet along Section line; thence S 72°54'35" E, 314.08 feet; thence S 63°06'41" E, 224.51 feet; thence S 48°18'17" E, 268.40 feet; thence S 20°06'29" W, 1066.85 feet; thence S 39°24'03" W, 846.37 feet, more or less tot eh Northerly right-of-way of SR-31; thence N 89°39'06" E, 139.42 feet along said right-of-way; thence N 43°39'42" E, 1520.19 feet; thence N 31°02'18" E, 412.96 feet; thence N 22°58'45" E, 1322.55 feet to the North line of Section 5, Township 17 South, Range 8 East, SLB&M; thence N 89°44'10" W, 744.58 feet along Section line to the point of beginning.

1.50 Completeness

The Applicant believes the information in this application to be complete and correct.

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TABLE 1-1

Related-Entity Permits

Entity and State	Permit	Issuing Authority	Status
BRC Alabama No. 7, LLC (Alabama) FEIN 32-0392802	Operator on Mine Permits P3247 (MSHA ID 01-03364 issued 5/24/2007), P3256 (MSHA ID 01-03365 issued 5/24/2007), P3257 (MSHA ID 01-03278 issued 5/1/2006), and P3260 (MSHA ID 01-03362 issued 4/20/2007)	Alabama Surface Mining Commission	Issued
BRC Chinook, LLC (Indiana) FEIN 37-1703437	Permittee on Mine Permit P-00004 (MSHA ID 12-02397 issued 3/23/2007)	Indiana Dept of Natural Resources	Issued
BRC Chinook, LLC (Indiana) FEIN 37-1703437	NPDES Permit No. ING040176 (MSHA ID 12-02397 issued 3/23/2007)	Indiana Dept of Environmental Management	Issued
BRC Chinook, LLC (Indiana) FEIN 37-01703437	SSOA 167-27370-00055 [Air Permit] (MSHA ID 12-02397 issued 3/23/2007)	Indiana Dept of Environmental Management	Issued
Minuteman (Kentucky) FEIN 36-4743728	Permittee on Mine Permit 889-8005 (MSHA ID 15-19205 issued 3/21/2008)	Kentucky Division of Mine Permits	Issued
Minuteman (Kentucky) FEIN 36-4743728	KPDES Permit No. 0107158 (MSHA ID 15-19205 issued 3/21/2008)	Kentucky Division of Water	Issued
Minuteman (Kentucky) FEIN 36-4743728	Air Permits S-07-145 (MSHA ID 15-19205 issued 3/21/2008) and S-08-039 (MSHA ID 15-19071 issued 12/6/2007)	Kentucky Division of Air Quality	Issued
Minuteman (Kentucky) FEIN 36-4743728	UIC Permit KYV0047 (MSHA ID 15-19205 issued 3/21/2008)	USEPA Region 4	Issued
Minuteman (Kentucky) FEIN 36-4743728	UIC Permit KYV0053 (MSHA ID 15-19205 issued 3/21/2008)	USEPA Region 4	Issued
BRC Pinnacle, LLC (West Virginia) FEIN 61-1696678	Operator on Mine Permit No. 0402292 (MSHA ID 46-09146 issued 2/18/2008)	WV Dept of Env. Protection	Issued
BRC Pinnacle, LLC (West Virginia) FEIN 61-1696678	Air Permit G10-C104 (MSHA ID 09146 issued 2/18/2008)	WV Department of Environmental Protection	Issued
BRC Alabama No. 5, LLC (Alabama) FEIN 61-1696887	Operator on Mine Permit P3199 (MSHA ID 01-00563 issued 7/1/2008)	Alabama Surface Mining Commission	Issued
BRC Wellington (Utah) FEIN 36-4743889)	Permittee on Mine Permit C/007/0045 (MSHA ID 42-02398 issued 2/10/2005)	Utah Division of Oil, Gas and Mining	Issued
BRC Wellington (Utah) FEIN 36-4743889)	Approval Order DAQE# AN2952001-03	Utah Division of Air Quality	Issued
BRC Wellington (Utah) FEIN 36-4743889)	UPDES Permit No. UTR000685	Utah Division of Water Quality	Issued

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TABLE 1-2

Affiliated Notices of Violation

Entity	Location	Permit Number	Description of Violation	Current Status	Actions to Abate
BRC Chinook, LLC	3589 North Country Road 500 West Brazil, IN 47834	P-00004	Non Compliance N40818-P-004 Submit Rec Plan & equipment necessary to backfill/grade prior to fall seeding deadlines.	Ongoing reclamation work being performed.	Submitted reclamation plan and have equipment on site backfilling and grading as of 10/22/2014
BRC Alabama No. 3, LLC	3318 Highway 3041 Corbin, KY 40702	861-8015	Non Compliance 23-2827 Failed to submit water monitoring reports for Q4 2013. Non Correctable as deadline has passed.	Water monitoring reports are being prepared and submitted in a timely manner.	Submitted Notification that required sampling for Q4 2013 had not been performed. Quarterly water monitoring reports are being filed.
BRC Alabama No. 3, LLC	3318 Highway 3041 Corbin, KY 40702	861-8015	Non Compliance 23-2835 Failure to maintain fresh water pond. Water seeping from pond.	Impoundment in is compliance with no seepage as of 12/29/2014	Repaired pond in order to prevent unapproved discharge from structure.
Bowie Refined Coal, LLC	898 Coal Wash Road Irvine, KY 40336	833-9006	Non Compliance 63-2989 1. Failure to notify State in a timely manner that warning elevations in piezometers were exceeded. 2. Failure to construct and operate impoundments in accordance with approved designs.	Completed remedial measures as of 7/23/2014.	Maintaining pool at the approved elevation. Construct all impoundments in accordance with approved permit design or diligently pursue the issuance of Minor Revision #4 in a timely manner.

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Entity	Location	Permit Number	Description of Violation	Current Status	Actions to Abate
Bowie Refined Coal, LLC	898 Coal Wash Road Irvine, KY 40336	833-9006	Non Compliance 63-2951 Sediment level in Effluent Control Pond reached an unacceptable level for impoundment to function properly.	Deadline of 3/6/2015 to Complete remedial measures to restore capacity.	Removing material from Effluent Control Pond until acceptable capacity is restored.
Bowie Refined Coal, LLC	898 Coal Wash Road Irvine, KY 40336	833-9006	Non Compliance 63-2394 1. Failure to maintain accurate 7 day records of crest elevation levels piezometers on coal waste dams. 2. Failure to maintain operating pool level. Records show levels exceeded approved elevation levels.	Deadline of 3/17/15 to Complete remedial measures. Currently verifying elevations of impoundments. Update the 7-day report with current geometry of structure, and with piezometer warning levels approved in the permit.	Verify elevation of pond crest, correct the discrepancy on 7-day inspection records, if different, return crest to approved elevation levels. The decant was extended to Stage 2 elevation so Stage 1 operating pool limit is no longer applicable.

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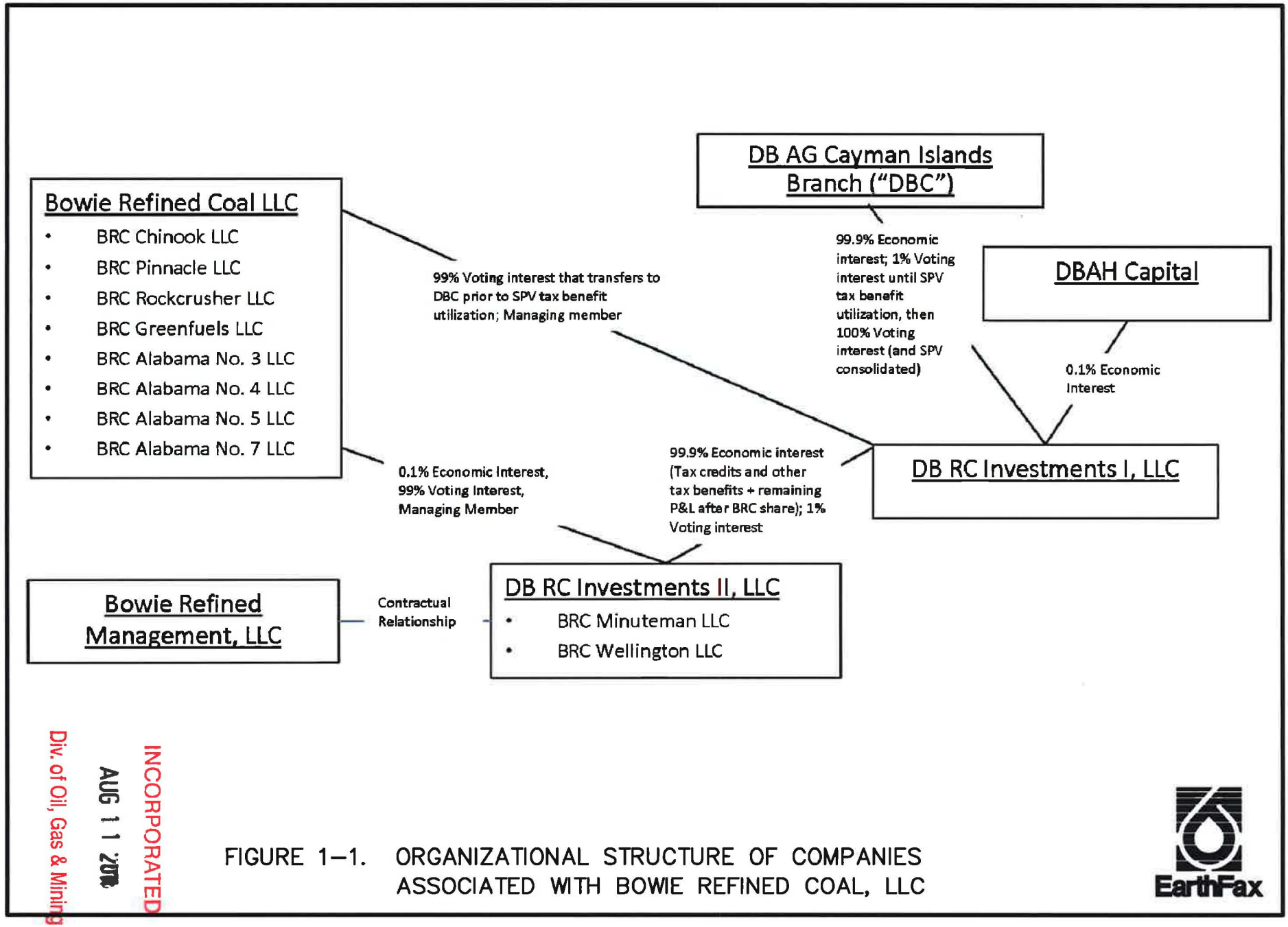

FIGURE 1–1. ORGANIZATIONAL STRUCTURE OF COMPANIES ASSOCIATED WITH BOWIE REFINED COAL, LLC

G:\UC1461\05 - Deer Creek waste rock\Draft MRP\DWG\FIGURE 1-1.dwg, 2/9/2015 2:32:51 PM
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APPENDIX 1-1

Property Asset Purchase and Sale Agreement

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ASSET PURCHASE AND SALE AGREEMENT

(HUNTINGTON WASTE ROCK SITE)

between

PACIFICORP

and

BRC WELLINGTON, LLC

dated as of

August 4, 2015

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Seller Exhibits and Disclosure Schedules

Schedule 1 -	Best of Seller's Knowledge
Schedule 2 -	Notice of Violation
Schedule 3 -	Permits
Schedule 4 -	Property Leases
Schedule 5 -	Real Property
Schedule 6 -	Consents
Schedule 7 -	Pending Litigation
Schedule 8 -	Hazardous Substances
Schedule 9 -	Notices of Default

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ASSET PURCHASE AND SALE AGREEMENT

THIS ASSET PURCHASE AND SALE AGREEMENT (this "***Agreement***") is made and entered into this 4th day of August, 2015 (the "***Effective Date***"), by and between PACIFICORP, an Oregon corporation, having a mailing address of 1407 W. North Temple, Salt Lake City, Utah 84116 ("***Seller***"), and BRC WELLINGTON, LLC, a Delaware limited liability company, having a mailing address of 6100 Dutchmans Lane, 11th Floor, Louisville, Kentucky 40205 ("***Buyer***"). Seller and Buyer may be collectively referred to herein as the "***Parties***" or individually as a "***Party***."

RECITALS

A. WHEREAS, Seller is the owner of the Purchased Assets (as defined in Section 1.1); and

B. WHEREAS, Buyer desires to purchase and acquire Seller's interest in the Purchased Assets from Seller, and Seller desires to sell and convey its interest in the Purchased Assets to Buyer, all subject to and in accordance with the terms and conditions of this Agreement.

AGREEMENT

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants and agreements hereinafter set forth, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged by the Parties, Seller and Buyer agree as follows:

ARTICLE I
DEFINITIONS

1.1 Certain Definitions. In this Agreement, capitalized terms and other defined terms described below shall have the meanings set forth or cross-referenced as follows:

"***Affiliate***" means any person, partnership, joint venture, corporation or other form of enterprise which directly or indirectly controls, is controlled by, or is under common control with, a Party hereto. For purposes of the preceding sentence, "control" (including the terms "controlled by" and "under common control with") means possession, directly or indirectly, of the power to direct or cause direction of management and policies through ownership of voting securities, contract rights, voting trust, or otherwise.

"***Agreement***" means this Asset Purchase and Sale Agreement and the Exhibit(s) and Schedules attached hereto (all of which Exhibit(s) and Schedules shall be deemed to be

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incorporated herein by reference and made a part hereof as if set out in full herein), and all agreements or instruments executed in connection herewith, including the Closing Agreements.

"Assumed Liability" has the meaning given in Section 3.2(a).

"Basket" has the meaning given in Section 11.2(c).

"*Best of Seller's knowledge*" means the knowledge and belief of Seller, based solely upon the actual knowledge of the individuals listed on Schedule 1.

"*Business Day*" means any day except Saturday, Sunday, or any other on which commercial banks located in Salt Lake City, Utah are authorized or required by Law to be closed for business.

"Buyer" has the meaning given in the Preamble.

"Cap" has the meaning given in Section 11.3.

"*Closing*" means the closing of this transaction which is described in more detail in Section 8.1.

"Closing Agreements" has the meaning given in Section 4.1(b)(i).

"*Closing Date*" has the meaning given in Section 8.1.

"Code" means the Internal Revenue Code of 1986, as amended.

"Consent" means any approval, consent, ratification, waiver, or other authorization.

"Effective Date" has the meaning given in the Preamble.

"*Encumbrances*" means any charge, claim, community property interest, deed of trust, condition, equitable interest, lien, mortgage, easement, encumbrance, servitude, right of way, option, pledge, purchase agreement, additional sale agreement, proxy, security interest, right of first refusal, or restriction of any kind, including any restriction on use, voting, transfer, receipt of income, or right of exercise of any other attribute of ownership.

"*Escrow Agent*" has the meaning as given in Section 2.3.

"*Excluded Assets*" means the assets described in Section 3.4.

"Excluded Liabilities" has the meaning given in Section 3.2(b).

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"Exhibit(s)" means the exhibits attached hereto.

"***Government Authority***" shall mean any national, state or local government or any subdivision, agency, court, commission, board, bureau, or other authority thereof.

"***Hazardous Substances***" means any hazardous, toxic, radioactive, or infectious substance, material, or waste which is regulated by any Government Authority, including any substance, material, or waste which is defined as a "hazardous waste," "hazardous material," "hazardous substance," "extremely hazardous waste," "restricted hazardous waste," "contaminant," "toxic waste," or "toxic substance" under any provision of Law, and including petroleum, petroleum products, asbestos, presumed asbestos-containing material or asbestos-containing material, urea formaldehyde, and polychlorinated biphenyls.

"***Indemnitee***" has the meaning given in Section 10.3(b).

"***Indemnitor***" has the meaning given in Section 10.3(b).

"***Law***" means any statute, law, ordinance, regulation, rule, code, order, constitution, treaty, common law, judgment, decree, other requirement or rule of law of any Government Authority.

"***Notice of Violation***" or "NOV" has reference to those notices of violation listed in Schedule 2.

"Party" or "Parties" has the meaning given in the Preamble.

"***Permits***" means the existing permits and applications for permits appurtenant or relating to the Purchased Assets as described on Schedule 3.

"***Permitted Encumbrances***" means those non-monetary exceptions, conditions, encumbrances, liens, and interests of record.

"***Property Leases***" means the leases, rights-of-way, easements, licenses, and agreements pertaining to real property included in the Purchased Assets as described on Schedule 4.

"***Property Taxes***" has the meaning given in Section 8.3(a).

"***Purchased Assets***" means all of Seller's right, title, and interest in the Real Property, the Permits and the Property Leases, and any other easements, rights-of-way, roads, improvements, haul ways, leases, and options and other realty relating to the Purchased Assets, but specifically excluding all Excluded Assets.

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"Real Property" means those parcels of real property situated in Emery County, State of Utah as more particularly described on Schedule 5.

"Refined Coal" shall mean the material produced by mining the coal refuse, including coarse coal and fines, located on the Real Property, and processing the same through a refined coal production facility.

"***Repurchase Right***" has the meaning given in Section 6.3.

"***Royalty***" has the meaning give in Section 6.1.

"Schedules" means Seller's disclosure schedules attached hereto.

"Seller" has the meaning given in the Preamble.

"***Seller's Disclosure List***" has the meaning given in Section 4.3.

"Tax" (including, with correlative meaning, the terms "Taxes," "Taxing," and "Taxable") shall mean all federal, state, local or foreign taxes, charges, fees, duties, imposts, levies or other similar assessments of any kind whatsoever imposed by any Government Authority.

"Ton" means two thousand (2,000) pounds avoirdupois.

ARTICLE II
AGREEMENT TO PURCHASE AND SELL; CONSIDERATION

2.1 Agreement to Purchase and Sell. Subject to the terms and conditions set forth herein, at the Closing, Seller shall sell, assign, transfer, convey and deliver to Buyer, and Buyer shall purchase from Seller, all of the Purchased Assets, free and clear of all Encumbrances except the Permitted Encumbrances.

2.2 Consideration. As consideration for the sale of the Purchased Assets and the other obligations of Seller hereunder, on the Closing Date, Buyer shall pay to Seller, subject to adjustment pursuant to Section 8.3 below, **Ten Thousand Dollars (USD $10,000.00)** (the "***Purchase Price***") in immediately available funds.

2.3 Escrow Agent. Unless otherwise agreed to by the Parties, the Closing of the transaction contemplated by this Agreement shall be facilitated by First American Title Insurance Company, 215 South State Street, #380, Salt Lake City, Utah 84111 (the "***Escrow Agent***").

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ARTICLE III
ASSETS TO BE SOLD AND PURCHASED

3.1 Assets to be Sold. The assets to be sold are the Purchased Assets.

3.2 Assumed Liabilities; Excluded Liabilities.

(a) Upon completion of the Closing, Buyer covenants and agrees to assume, fulfill, perform and in due course discharge, only the following obligations and liabilities (collectively, the "***Assumed Liabilities***"):

(i) The asset retirement and reclamation obligations, including but not limited to environmental remediation obligations, if any, with respect to the Purchased Assets, whether arising before or after the Closing Date;

(ii) The post-Closing obligations and liabilities of Seller under the Property Leases and Permits that, by their terms, arise after the Closing Date, relate to periods following the Closing Date, and are to be observed, paid, discharged or performed, as the case may be, at any time after the Closing Date (excluding, for the avoidance of doubt, any obligations under the Property Leases or Permits arising from breaches thereof or otherwise on or prior to the Closing Date); and

(iii) All other obligations and liabilities relating to the Purchased Assets that, by their terms, arise after the Closing Date, relate to periods following the Closing Date, and are to be observed, paid, discharged or performed, as the case may be, at any time after the Closing Date.

(b) Buyer shall not assume any liability or obligation arising from or relating to a breach by Seller of a representation, warranty or covenant set forth in this Agreement. Furthermore, except for the Assumed Liabilities, Buyer shall not assume, and Seller shall remain liable, responsible for, and shall retain, and timely pay, perform and discharge, any and all other debts, obligations, and liabilities of Seller and its Affiliates, whether known, unknown, contingent, executory, fixed or otherwise, including without limitation, all pending litigation, if any, as described on Schedule 7. All of the matters referenced in this Section 3.2(b) shall be referred to as "***Excluded Liabilities***".

3.3 Possession; Risk of Loss; "As Is" Purchase. Possession of, risk of loss to, and responsibility for the Purchased Assets shall be delivered to Buyer on the Closing Date. Notwithstanding any other term or condition of this Agreement, any and all risk of loss to and

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responsibility for the Purchased Assets shall remain with Seller until such time as the Closing shall have been consummated according to the terms and conditions of this Agreement.

UPON CLOSING, BUT WITHOUT QUALIFYING, WAIVING, LIMITING, OR RELEASING, OR OTHERWISE AFFECTING THE BUYER'S RIGHT TO RELY ON, THE REPRESENTATIONS, COVENANTS, WARRANTIES, INDEMNITIES, AND AGREEMENTS OF THE SELLER SET FORTH IN THIS AGREEMENT, THE BUYER SHALL HAVE CONDUCTED SUCH INVESTIGATIONS WITH RESPECT TO THE PURCHASED ASSETS AS THE BUYER DEEMS ADVISABLE, AND SHALL HAVE SATISFIED ITSELF WITH RESPECT TO THE CONDITION OF THE PURCHASED ASSETS, AND THE TRANSACTIONS CONTEMPLATED BY THIS AGREEMENT. FURTHER, WITHOUT QUALIFYING, WAIVING, LIMITING, OR RELEASING, OR OTHERWISE AFFECTING THE BUYER'S RIGHT TO RELY ON, THE REPRESENTATIONS, COVENANTS, WARRANTIES, INDEMNITIES, AND AGREEMENTS OF THE SELLER SET FORTH IN THIS AGREEMENT AND EXCEPT AS MAY BE OTHERWISE AGREED BY THE BUYER AND THE SELLER, THE BUYER SHALL ACCEPT THE PURCHASED ASSETS IN THE CONDITION IN WHICH THEY EXIST UPON THE CLOSING (THAT IS, "AS IS" AND "WHERE IS", "WITH ALL FAULTS"), WITHOUT ANY OTHER REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, IN FACT OR BY LAW.

3.4 Excluded Assets. The Purchased Assets shall not include any personal property and movable assets of Seller (collectively, the "***Excluded Assets***").

ARTICLE IV
REPRESENTATIONS AND WARRANTIES

4.1 Representations and Warranties of Seller. Seller represents and warrants to Buyer that the items set forth below in this Section 4.1 are and shall be true and correct as of the date hereof and as of the Closing Date:

(a) **Corporate Standing.** Seller is a corporation duly organized and validly existing and in good standing under the laws of the State of Oregon, has corporate power to execute, deliver, and carry out the terms and provisions of this Agreement, and to carry on its business as now being conducted; and as necessary, is duly qualified to do business in and is in good standing in the State of Utah.

(b) **Authorizations; Binding Agreements; Consents; Non-Contravention.**

(i) The execution, delivery and performance of this Agreement by Seller and each conveyance, assignment, agreement, and other document herein contemplated to be executed by Seller, has been duly authorized by all necessary corporate action. This Agreement and the specific

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conveyances, assignments, agreements, and other documents (collectively, the "***Closing Agreements***") contemplated herein to be executed by Seller are, or will be upon execution, legal, valid and binding obligations of Seller, duly enforceable against Seller in accordance with their terms. Seller has the absolute and unrestricted right, power, and authority to execute, deliver, and, subject to any Consents as set forth in Schedule 6, perform its obligations under this Agreement and the Closing Agreements.

(ii) Except as set forth on Schedule 6, no Consent, approval, action or authorization of any third party, or application to, or other notice or filing with, a third party, including any Government Authority, is required for the execution, delivery or performance of this Agreement or the Closing Agreements or the consummation of the transactions contemplated hereby or thereby by Seller.

(iii) Seller's execution, delivery, and performance of this Agreement and the Closing Agreements do not and will not result in any violation of or be in conflict with the terms of Seller's articles of incorporation or bylaws; and subject to any Consents set forth on Schedule 6, do not and will not violate or conflict with any permit, lease, venture, mortgage, agreement, contract, judgment, order or other obligation or restriction to which Seller or the Purchased Assets may be bound or encumbered.

(c) **Taxes.** All Tax returns and reports relating to the Purchased Assets required by Law (including, without limiting the scope of the foregoing, all federal, state, and local property Tax, severance and franchise Tax laws) to be filed by Seller prior to the Closing have been duly filed or will be caused to be filed and the Taxes due thereunder paid, if any.

(d) **Brokers or Finders Fees.** No obligation or liability, contingent or otherwise, for brokers or finder's fees, agents' commissions, or similar payments created by Seller with respect to the matters provided for in this Agreement shall be imposed upon Buyer.

(e) **No Imposition of Liens.** With exception of the Repurchase Right, the consummation of the sale by Seller shall not result in the imposition of any Encumbrance upon any of the Purchased Assets.

(f) **Title to Purchased Assets.** Subject to the Permitted Encumbrances, Seller owns the Purchased Assets, free and clear of any Encumbrances (other than Taxes not yet due and payable and with exception of Seller's general corporate mortgage, which shall be released as to the Purchased Assets prior to Closing).

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(g) **Applicable Agreements.** The Permits and the Property Leases are the only material agreements to which the Purchased Assets are bound. There are no renegotiations or amendments of, attempts to renegotiate or amend, or outstanding rights to renegotiate or amend any of the Permits or the Property Leases.

(h) **Pending Litigation.** Except for any Notice(s) of Violation disclosed in Schedule 2 and any pending litigation as disclosed on Schedule 7, (i) there are no actions, suits, arbitrations, or proceedings currently pending against or affecting the Purchased Assets, and (ii) to the Best of Seller's knowledge, there are no claims or threatened claims against or liabilities affecting the Purchased Assets.

(i) **No Default of Orders, Etc.** There is no order, judgment, writ, injunction, decree or award of any court or arbitrator that affects the Purchased Assets.

(j) **Compliance with Laws and Regulations.** Seller is in material compliance with all currently effective applicable Laws as currently interpreted by regulatory agencies concerning the Purchased Assets. Except as disclosed on Schedule 2, Seller has not received or has any knowledge of any actual or threatened order, notice, citation, directive, summons, warning, or other communication from any Government Authority or from any private citizen acting in the public interest or from any prior owner or operator of the Purchased Assets or any other third person of any actual or potential violation or failure to comply with any applicable Laws.

(k) **Hazardous Substances.** To the Best of Seller's knowledge, except as disclosed on Schedule 8, (i) no Hazardous Substance has been disposed of, spilled, leaked or otherwise released on, under or from the properties included in the Purchased Assets in a reportable quantity; (ii) no wastes in reportable quantities (including without limitation garbage and refuse) have been disposed of on the properties included in the Purchased Assets; and (iii) there are no underground storage tanks on the properties included in the Purchased Assets. There is no PCB-bearing equipment on the Real Property or included as part of the Purchased Assets.

(l) **Status of Property Leases.** The Property Leases are valid and in good standing, and, except as disclosed to Buyer on Schedule 9, there is no default thereunder. Except as disclosed on Schedule 9, Seller has received no notice of default under any Property Lease. The Property Leases constitute all of the agreements and leases in which Seller has an interest relating to the Real Property.

(m) **Validity of Permits.** The Permits, except as disclosed on Schedule 2, are valid and in full force and effect. Except as set forth in Schedule 2, Seller is in compliance with the Permits, except only such violations and instances of noncompliance as, separately and in the aggregate, are not material to the value of the Purchased Assets and have been completely abated

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prior to the date hereof. The Permits are the only permits, approvals, authorizations or licenses necessary to permit Seller to lawfully conduct and operate its business on the Real Property.

4.2 Limitation of Warranties and Representations. Neither Seller nor its Affiliates make, or have made, any representation or warranty, express or implied, concerning or related to the Purchased Assets, except as expressly provided in Section 4.1. Buyer has conducted, at its sole cost and expense, its due diligence examination of the Purchased Assets as Buyer deemed appropriate. Buyer has relied on its investigation and on the representations and warranties set forth herein in entering into this Agreement.

4.3 Changes Prior to Closing. Up to ten (10) days prior to the Closing, Seller shall provide Buyer with a list of any knowledge acquired or events occurring after the Effective Date that cause Seller's representations and warranties in Section 4.1 to be untrue in any material respect or are reasonably likely to cause them to be untrue in any material respect (***"Seller's Disclosure List"***). The Seller's Disclosure List shall not be deemed to (i) amend or supplement the Schedules for purposes of the conditions to Closing provided in Section 7.2, or (ii) prevent or cure any misrepresentation or breach of a warranty or covenant contained herein.

4.4 Representations and Warranties of Buyer. Buyer represents and warrants that the items set forth below in this Section 4.4 are and shall be true and correct as of the date hereof and as of the Closing Date:

(a) **Corporate Standing.** Buyer is a limited liability company duly organized, validly existing, and in good standing under the laws of the State of Delaware, has corporate power to execute, deliver, and carry out the terms and provisions of this Agreement; to carry on its business as now being conducted; and as necessary is qualified to do business and is in good standing in the State of Utah.

(b) **Authorizations; Binding Agreements; Consents; Non-Contravention.**

(i) The execution, delivery and performance of this Agreement by Buyer and each conveyance, assignment, agreement, and other document herein contemplated to be executed by Buyer, has been duly authorized by all necessary corporate action. This Agreement and the Closing Agreements to be executed by Buyer are, or will be upon execution, legal, valid and binding obligations of Buyer, duly enforceable against Buyer in accordance with their terms. Buyer has the absolute and unrestricted right, power, and authority to execute, deliver, and perform its obligations under this Agreement and the Closing Agreements.

(ii) No Consent, approval, action or authorization of any third party, or application to, or other notice or filing with, a third party, including any Government Authority, is required for the execution, delivery or performance of this Agreement or the Closing Agreements or the

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consummation of the transactions contemplated hereby or thereby by Buyer.

(iii) Buyer's execution, delivery, and performance of this Agreement and the Closing Agreements do not and will not result in any violation of or be in conflict with the terms of Buyer's Certificate of Formation or Limited Liability Company Agreement; and subject to any Consents, do not and will not violate or conflict with any permit, lease, venture, mortgage, agreement, contract, judgment, order or other obligation or restriction to which Buyer may be bound or encumbered.

(c) **No Brokers or Finders Fees.** No obligation or liability, contingent or otherwise, for brokers or finder's fees, agents' commissions, or similar payments created by Buyer with respect to the matters provided for in this Agreement shall be imposed upon Seller.

ARTICLE V
CONDUCT OF BUSINESS

5.1 Operations by Seller. The following provisions shall govern any activities conducted on or related to the Purchased Assets after the Effective Date and prior to the Closing Date:

(a) Seller will, or cause its contractor to, maintain the Purchased Assets in compliance with regulatory, local land use and environmental protection requirements.

(b) Seller will, subject to Section 5.3, cooperate prior to the Closing in orienting Buyer's personnel to the Purchased Assets.

(c) Seller shall pay or otherwise satisfy in the ordinary course of its business all liabilities and obligations associated with or related to the Purchased Assets.

5.2 Seller's Covenants. Pending the Closing, Seller shall:

(a) (i) not directly or indirectly entertain, solicit, initiate, accept or encourage any inquiries, offers or proposals from, discuss or negotiate with, provide any non-public information to, or consider the merits of any unsolicited inquiries or proposals from, any person (other than Buyer and its Affiliates) relating to any transaction involving the sale or lease of any of the Purchased Assets, and (ii) not participate in any discussions or negotiations regarding, furnish any information with respect to, assist or participate in, or facilitate in any other manner any effort or attempt by any person to do or seek, any of the foregoing;

(b) not enter into any contract or commitment relating to the Purchased Assets, or cancel or modify or in any way impair any of the Permits or the Property Leases.

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(c) comply, at its sole expense, with all requirements, regulations, and obligations related to the subdivision of the Real Property, including the Emery County, Utah zoning ordinance and obtain all necessary approvals from the Emery County Commission for the sale of the Real Property.

5.3 Access by Buyer. Buyer and its duly authorized agents, employees and representatives, at their sole risk and expense, shall have reasonable access to the Purchased Assets for familiarization and orientation purposes upon one (1) days' notice to Seller. Buyer agrees to indemnify, defend, and hold harmless Seller and its directors, officers, agents, representatives, subsidiaries and Affiliates with respect to such activities in accordance with Section 10.3.

5.4 Confidentiality. All information provided by Seller to Buyer will be kept confidential and will not, without the prior written consent of the Seller, be disclosed by the Buyer or its representatives, in any manner whatsoever, in whole or in part, and will not be used by Buyer or its representatives directly or indirectly for any purpose other than evaluating the Purchased Assets and closing the transaction contemplated by this Agreement. Moreover, Buyer agrees to transmit the information only to those representatives who need to know the information for the purpose of evaluating and closing the transaction contemplated by this Agreement and who agree to be bound by the terms of this Agreement. Buyer will be responsible for any breach of this Agreement by its representatives. The information is supplied for informational purposes only and Seller makes no representations or warranties either express or implied, concerning the completeness or accuracy of the information except as specifically set forth herein. Further, all information provided by Buyer to Seller will be kept confidential and will not, without the prior written consent of the Buyer, be disclosed by Seller or its representatives, in any manner whatsoever, in whole or in part, and will not be used by Seller or its representatives directly or indirectly for any purpose other than evaluating and closing the transactions contemplated by this Agreement. Moreover, Seller agrees to transmit the information only to those representatives who need to know the information for the purpose of evaluating and closing the transaction contemplated by this Agreement and who agree to be bound by the terms of this Agreement. Seller will be responsible for any breach of this Agreement by its representatives. The information is supplied for informational purposes only and Buyer makes no representations or warranties either express or implied, concerning the completeness or accuracy of the information except as specifically set forth herein. The obligations of confidentiality, non-disclosure and limited use imposed by this Agreement shall not apply to information, data or materials that are required to be disclosed to a Governmental Authority or in connection with any regulatory approval process of any state public utility/service commission with jurisdiction over the Seller's, or its Affiliate's, business operations.

5.5 Joint Obligations. The following shall apply with equal force to Seller and Buyer:

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(a) Neither Party shall intentionally perform any act which, if performed (or omit to perform any act which, if omitted to be performed) would prevent or excuse the performance of this Agreement by either Party hereto or which, except as a result of the conduct of the business in the usual and ordinary course, would result in any representation or warranty herein contained being untrue in any material respect if made on and as of the Closing.

(b) Buyer and Seller agree to cooperate with each other and to use reasonable efforts to obtain all other governmental and third party consents and approvals necessary to complete the transactions contemplated by this Agreement.

ARTICLE VI
ROYALTY PAYMENT / REPURCHASE RIGHT

6.1 Royalty Payment. Concurrent with the Closing, Buyer grants to Seller a royalty equal to Three Dollars ($3.00) per ton on all Refined Coal tons produced from the coal refuse, including coarse coal and fines, located on the Real Property, and sold to a third party (the "***Royalty***"). Payment of the Royalty to Seller shall be made to PacifiCorp on a monthly basis with payment made on or before the end of the calendar month following the end of the month in which the Refined Coal is sold. All Royalty payments under this Agreement may be paid or tendered directly to Seller's credit as follows:

PACIFICORP
JPMorgan
1 Chase Manhattan Plaza, Floor 07
New York, NY 10005-1401
ABA 021000021
Checking Account 5531896

Seller, at its sole election and expense, shall have the right to perform, not more frequently than once annually following the close of each calendar year, an audit of Buyer's accounts relating to the Royalty. Any such inspection shall be for a reasonable length of time during regular business hours, at a mutually convenient time, upon at least ten (10) business days' prior written notice by Seller. All Royalty payments made in any calendar year shall be considered final and in full accord and satisfaction of all obligations of Buyer, unless Seller gives written notice describing and setting forth a specific objection to the calculation thereof within one (1) year following the end of that calendar year. Buyer shall account for any agreed upon deficit or excess in Royalty payments made to Seller by adjusting the next statement and payment following completion of such audit to account for such deficit or excess.

6.2 Federal, State, or Private Coal Royalties. The Parties acknowledge that the coal material located on the surface of the Real Property originated from Seller's Deer Creek Mine, and is considered waste coal by Seller. The Parties further acknowledge that any coal

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located on the Real Property may have originated from third party-owned private land, or state or federal coal leases within the Deer Creek Mine property, but that such coal has been intermingled and, therefore, Seller has no means of determining the specific origin (private, state or federal mineral lands) of the coal located within the Real Property. In addition, given the nature of the coal on the Real Property, Seller has no intention of attempting to process and recover the waste coal. Buyer agrees that in the event the United States government, the State of Utah or any private party attempts to recover a royalty for the coal removed from the Real Property by Buyer, Buyer shall be solely responsible for responding to and defending against such attempt, and for payment of any royalties if it is determined that such royalties must be paid.

Furthermore, Buyer shall indemnify, defend and hold harmless Seller and its Affiliates and their respective directors, officers, managers, agents, representatives, subsidiaries, successors and assigns from and against any and all claims, demands or suits (by any party, including without limitation, any governmental agency), losses, liabilities, damages, obligations, payments, costs and expenses (including, without limitation, the costs and expenses of defending any and all actions, suits, proceedings, demands and assessments which shall include reasonable attorneys' fees and court costs) resulting from, relating to, arising out of, or incurred in connection with any claim by the United States, the State of Utah, or any private party alleging royalties are owed and due on the coal removed from the Real Property by Buyer.

6.3 Right to Repurchase. The Parties acknowledge that the Buyer's intent in acquiring the Purchased Assets is to remove and process coal from the waste rock. Therefore, once Buyer has completed the removal of the coal from the waste rock, completed the reclamation of the Real Property in accordance with the Permits and all applicable state and federal requirements, and received release of all reclamation bonds, Seller shall have the right to reacquire the Purchased Assets, free and clear of all monetary liens and subject only to the Permitted Encumbrances, for a purchase price of One Dollar ($1.00) (the "***Repurchase Right***"). Within six (6) months of Buyer completing its coal removal activities on the Real Property, Buyer shall commence reclamation activities, and work diligently to complete such reclamation in a timely manner. Within thirty (30) days of receiving release of the reclamation bonds for the Real Property, Buyer shall provide Seller notice of such release. Thereafter, Seller shall have one (1) year to notify Buyer of its intent to repurchase the Purchased Assets. Upon Seller notifying Buyer of its intent to repurchase the Purchased Assets, Buyer shall transfer the Purchased Assets to Seller by Special Warranty Deed within sixty (60) days.

Seller's Repurchase Right shall be evidenced in the Special Warranty Deed conveying the Real Property at Closing (of the transaction contemplated by this Agreement) from Seller to Buyer.

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ARTICLE VII
CONDITIONS PRECEDENT TO CLOSING; TERMINATION

7.1 Conditions Precedent to the Obligations of Seller. The obligation for Seller to consummate the transactions contemplated by this Agreement is subject to the satisfaction, on or prior to the Closing, of the following conditions (any one or more of which may be expressly waived in writing by Seller):

(a) No proceeding shall have been instituted before any Government Authority by any person (other than a Party hereto) (i) making any challenge to, or seeking damages or other relief in connection with, the transactions contemplated by this Agreement, or (ii) that may have the effect of restraining, enjoining or prohibiting, making illegal or otherwise interfering with such transactions.

(b) The representations and warranties of Buyer contained herein shall have been true in all material respects when made and shall be true in all material respects as if originally made on and as of the Closing, without giving effect to any limitation or qualification as to "materiality" (including the word "material").

(c) Buyer shall have performed and complied in all material respects with all agreements and conditions required by this Agreement to be performed and complied with prior to or at Closing.

(d) All deliveries by Buyer set forth in Section 8.2 shall have been made.

7.2 Conditions Precedent to the Obligations of Buyer. The obligation of Buyer to consummate the transaction contemplated by this Agreement is subject to the satisfaction, on or prior to the Closing, of the following conditions (any one or more of which may be waived in writing by Buyer):

(a) No proceeding shall have been instituted before any Government Authority by any person (other than a Party hereto) (i) making any challenge to, or seeking damages or other relief in connection with, the transactions contemplated by this Agreement, or (ii) that may have the effect of restraining, enjoining or prohibiting, making illegal or otherwise interfering with such transactions.

(b) The representations and warranties of Seller contained herein shall have been true in all material respects when made and shall be true in all material respects as if originally made on and as of the Closing, without giving effect to any limitation or qualification as to "materiality" (including the word "material").

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(c) Seller shall have in all material respects performed and complied with all agreements and conditions required by this Agreement to be performed or complied with prior to or at Closing, including, without limitation, obtaining all necessary subdivision approvals from Emery County, Utah.

(e) All deliveries by Seller set forth in Section 8.2 shall have been made.

7.3 Termination.

(a) This Agreement may be terminated prior to the Closing as follows:

(i) at the election of the Seller, if any one or more of the conditions to the obligation of Seller to close has not been fulfilled as of the Closing, in which event Seller shall provide written notice of termination to Buyer;

(ii) at the election of the Buyer, if any one or more of the conditions to the obligation of Buyer to close has not been fulfilled as of the Closing, in which event Buyer shall provide written notice of termination to Seller;

(iii) at the election of the Seller, if the Buyer has breached any representation, warranty, covenant or agreement contained in this Agreement, which breach would have a material adverse effect on the transaction contemplated by this Agreement and which cannot be or is not cured by the Closing, in which event Seller shall provide written notice of termination to Buyer;

(iv) at the election of the Buyer, if the Seller has breached any representation, warranty, covenant, or agreement contained in this Agreement, which breach would have a material adverse effect on the transaction contemplated by this Agreement and which cannot be or is not cured by the Closing, in which event Buyer shall provide written notice of termination to Seller;

(v) at any time on or prior to the Closing Date, by mutual written consent of the Seller and the Buyer.

7.4 Effect of Termination. Each Party's right of termination under Section 7.3 is in addition to any other rights it may have under this Agreement or otherwise, and the exercise of such right of termination will not be an election of remedies. If this Agreement is terminated pursuant to Section 7.3, all obligations of the Parties will terminate, except the provisions of Sections 5.4 and 11.1. A Party who terminates this Agreement pursuant to Section 7.3 shall have no liability to the other Party in respect of such termination.

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ARTICLE VIII
CLOSING

8.1 Time and Place of Closing. Subject to the terms and conditions of this Agreement, the purchase and sale of the Purchased Assets contemplated hereby shall take place at a closing (the "***Closing***") to be held at 9:00 a.m., Salt Lake City, Utah time, no later than ten (10) Business Days after the later of (1) last of the conditions to Closing set forth in Section 7.1 and 7.2 have been satisfied or waived (other than conditions which, by their nature, are to be satisfied on the Closing Date), or (2) the approval of the subdivision of the Real Property as set forth under Section 5.2(c), at the offices of Stoel Rives LLP, 201 South Main Street, Suite 1100, Salt Lake City, Utah 84111, or at such other time or on such other date or at such other place as Seller and Buyer may mutually agree upon in writing (the day on which the Closing takes place being the "***Closing Date***").

8.2 Actions at Closing. At the Closing, the following events shall occur, each being a condition precedent to the other and each being declared to have occurred simultaneously with the other:

(a) Seller shall execute, acknowledge and deliver to Buyer a special warranty deed, assignments and other documents necessary to transfer all of Seller's right, title, and interest in and to the Purchased Assets to Buyer free and clear of all Encumbrances, other than Permitted Encumbrances and the Repurchase Right, and complete the transaction as anticipated under this Agreement.

(b) Subject to Section 9.1, Seller shall deliver original executed copies of all Consents (if any) to the assignment of the Property Leases and any other necessary Consents.

(c) The Seller and Buyer shall execute such documents and certificates evidencing (i) the accuracy of the representations and warranties included in Article IV of this Agreement, (ii) Seller's and Buyer's performance of or compliance with any covenant or obligation required to be performed hereunder, and (iii) the satisfaction of any conditions precedent to Seller's or Buyer's obligations hereunder. Such documents may also include, without limitation, closing statements, reflecting the adjustments, payments and credits described in this Agreement. Seller and Buyer shall take such other actions as are reasonably necessary and appropriate to effectuate the Closing in accordance with this Agreement.

8.3 Adjustments to Consideration.

(a) All ad valorem taxes, real property taxes, personal property taxes, and similar obligations ("***Property Taxes***") with respect to the tax year in which the Closing occurs shall be apportioned as of the Closing Date between Seller and Buyer. Prorations shall be made as of the Closing Date, and appropriate credit shall be given for the Property Taxes and other similar matters based upon 2014 or, if then available, 2015 taxes for the real property.

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(b) The collective amount of Property Taxes to be prorated in subpart (a) of this section will be calculated by the Seller on a state-specific basis by multiplying the net book value of the Purchased Assets by an assessment ratio and then by a composite state-wide property tax rate. The applicable assessment ratio will be calculated by dividing the net book value of all state assessed property by the assessed value of the Purchased Assets prior to any adjustment for state specific exemptions. The applicable state-wide property tax rate will be calculated by dividing the amount of Property Taxes paid for state assessed property for the most recent year by the corresponding assessed value of the Purchased Assets.

(c) Seller shall pay any sales taxes assessed upon transfer of any of the Purchased Assets.

(d) Seller and Buyer shall split equally all escrow and closing fees charged by the Escrow Agent.

8.4 Post-Closing Adjustments. Except as provided in such Section 8.3(a), the Parties will determine adjustments referenced in Section 8.3, to the extent they have not been completed at the Closing, within ninety (90) days after the Closing and cause payment of appropriate funds to be made to either Buyer or Seller, as the case may be.

ARTICLE IX
PRIOR APPROVALS

9.1 Permits. Seller and Buyer shall make every reasonable effort before the Closing to obtain approvals for transfer of all Permits. After the Closing, Buyer shall make every reasonable effort to effect transfer of all Permits and replace all bonds (if any), and if necessary, make applications for new permits to replace the obligations on the existing Permits, with any cost or expense associated with such transfer or application being for the account of Buyer. Buyer shall submit applications for transfer of the Permits or new permits related to the Purchased Assets no later than ten (10) days after the Closing Date. Seller shall cooperate with Buyer in all its efforts to apply for and obtain approvals for transfer of all Permits. Notwithstanding the deferred transfer of any of the Permits to Buyer, or receipt of necessary consents, Buyer shall assume all responsibilities and liabilities under the Permits as of the Closing Date except for any Excluded Liabilities related thereto.

9.2 Property Leases. In the event that any of the Property Leases cannot validly be assigned to Buyer at or before the Closing Date, Buyer shall have the option to waive the conditions of Closing with respect to such unassignability. Any such consent shall not be a condition to Closing if the unassignable Property Lease, as applicable (i) is not material to the operation of the Purchased Assets, and (ii) if Seller delivers to Buyer at Closing its written assurance and agreement, in such form as Buyer's counsel may reasonably request, to the effect

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that Seller, until such time as Seller obtains the necessary consent to assignment of and assigns such Property Lease;

(a) can and will maintain such contract in full force and effect for its duration;

(b) will provide to Buyer the full benefit thereof; and

(c) will accord to Buyer all of Seller's rights and privileges thereunder and exercise all such right for the benefit and at the direction of Buyer without additional cost or expense to Buyer on account thereof, provided that Buyer performs or tenders to Seller performance of all of the obligations of Seller (other than ministerial or administrative acts which by their nature can reasonably be performed only by Seller) required by the terms of such contract to avoid a material breach thereof by Seller.

ARTICLE X
INDEMNIFICATION

10.1 Obligations of Seller. Seller shall indemnify, defend and hold harmless Buyer and its Affiliates and their respective directors, officers, managers, agents, representatives, subsidiaries, successors and assigns from and against any and all claims, demands or suits (by any party, including without limitation, any governmental agency), losses, liabilities, damages, obligations, payments, costs and expenses (including, without limitation, the costs and expenses of defending any and all actions, suits, proceedings, demands and assessments which shall include reasonable attorneys' fees and court costs) resulting from, relating to, arising out of, or incurred in connection with any of the following:

(a) Any breach by Seller of any of Seller's representations or warranties contained in this Agreement;

(b) Any breach by Seller of any of Seller's covenants contained in this Agreement; and

(c) All Excluded Liabilities.

10.2 Obligations of Buyer. Buyer shall indemnify, defend, and hold harmless Seller and its parent corporation, and their respective directors, officers, agents, representatives, subsidiaries and Affiliates, from and against any and all claims, demands, or suits (by any party including, without limitation, any governmental agency), losses, liabilities, damages, obligations, payments, costs and expenses (including, without limitation, the original costs of defending any and all actions, suits, proceedings, demands and assessment which shall include reasonable attorneys' fees and court costs) resulting from, relating to, arising out of or incurred in connection with any of the following:

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(a) Any breach by Buyer of any of Buyer's representations or warranties contained in this Agreement;

(b) Any breach by Buyer of any of Buyer's covenants contained in this Agreement;

(c) All Assumed Liabilities; and

(d) Any actions of Buyer or its Affiliate on the Real Property following the Closing.

10.3 Indemnity Procedures.

(a) Notwithstanding any provision to the contrary included in this Article X, each Party hereto waives the right, for itself and its respective Affiliates, to be indemnified by the other Party hereto to the extent of any insurance proceeds or other recovery it receives with respect to the liabilities for which indemnification would otherwise be required hereunder. (For the purposes of this paragraph, insurance proceeds shall not include any payments received pursuant to an insurance program under which the Party seeking indemnification or an Affiliate of such Party bears the ultimate cost.)

(b) A Party claiming indemnification under this Article X (the "***Indemnitee***") shall notify in writing the Party from whom indemnification is claimed (the "***Indemnitor***") in reasonable detail of the nature, basis, and estimated amount of the claim within a reasonable time after discovery by the Indemnitee of the basis therefor or the assertion thereof by a third party against the Indemnitee. Notice of a claim filed in any court or administrative agency, or submitted to arbitration, shall be given to the Indemnitor within ten (10) days of the Indemnitee's receipt of such filing, but failure to provide notice within the ten (10) days shall not result in forfeiture of indemnification rights except to the extent that the ability of the Indemnitor to defend against the claim is materially impaired. In the event of such notice by the Indemnitee to the Indemnitor of a third party claim, the Indemnitor shall have twenty (20) days after receipt thereof in which to admit or deny responsibility for indemnification of the Indemnitee by written notice to the Indemnitee, and

(i) as to claims with respect to which the Indemnitee and the Indemnitor may share responsibility, each Party may elect to participate in the defense of the claim through counsel of its choice and at its expense, and neither Party shall settle or compromise the claim without the consent of the other; and

(ii) if the Indemnitor denies responsibility or fails to admit or deny responsibility for a claim within twenty (20) days of the notice, the Indemnitee shall have the sole option and right to defend the claim, including the right to settle or compromise the claim, by counsel of its choice.

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(c) The Indemnitee shall give to the Indemnitor full access to investigate the subject matter of the claim and, at the request of the Indemnitor, to allow it at its own expense to participate in, or have the conduct of (as it may elect), all proceedings of whatsoever nature against the relevant third party arising out of, or in connection with, such liability or dispute.

ARTICLE XI
REMEDIES AND SURVIVAL

11.1 Survival of Representations and Warranties; Right to Indemnification. Subject to the provisions of this Article XI, all of the representations and warranties of the Parties contained in Article IV of this Agreement shall survive Closing for a period of eighteen (18) months, except for the representations and warranties in Section 4.1(c) which shall survive for the applicable statute of limitations. All covenants of the Parties in this Agreement will survive the Closing without limitation. The right to indemnification, reimbursement, or other remedy based upon such representations, warranties, covenants, and agreements shall not be affected by any investigation (including environmental investigation or assessment) conducted with respect to, or any knowledge acquired or capable of being acquired) at any time, whether before or after the Effective Date or the Closing Date, with respect to the accuracy or inaccuracy of or compliance with any such representation or warranty, or on the performance of or compliance with any covenant or agreement.

11.2 Limitation. An Indemnitor shall not be liable in respect of any claim for breach of any representation or warranty under Sections 10.1(a) or 10.2(a) made by an Indemnitee under this Agreement or in any certificates or documents delivered at Closing:

(a) if the subject matter of the claim was disclosed in the Schedules;

(b) unless written notice of the claim, specifying in reasonable detail the matter which gives rise to the claim, the nature of the breach and the amount claimed in respect thereof, shall have been given by the Indemnitee to the Indemnitor within eighteen (18) months after the Closing Date, except with respect to claim for a breach of a representation or warranty set forth in Section 4.1(c) which may be brought at any time prior the expiration of the applicable statute of limitations;

(c) subject to Section 11.3 below, unless the aggregate amount of the claimed liability in respect of all such breaches exceeds Four Thousand Dollars and No/100 ($4,000.00) ("***Basket***"), at which time the Indemnitee may seek indemnification for all such breaches without regard to the Basket;

(d) to the extent that the Indemnitee is entitled to any savings or benefits as a result of such loss or to recover all or any portion of the claimed liability from any third party, whether

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by way of insurance proceeds (subject to Section 10.3(a)), reduction of taxes payable or otherwise;

(e) to the extent that such claim arises as a result of:

(i) any alteration in rates of taxation after the Closing with retrospective effect; or

(ii) the passing of, or any change in, any legislation after Closing.

(f) and to the extent that a claim is increased as a result of any of the matters set out in paragraph (e) above, the Indemnitor shall not be liable in respect of the amount by which the claim is so increased.

11.3 Maximum Amount. Except as provided below, the aggregate amount of the liability of the Seller for all claims with respect to the breach of any representations or warranties pursuant to Section 10.1(a) of this Agreement shall not exceed Ten Thousand Dollars ($10,000) (***"Cap"***). Except as provided below, the aggregate amount of the liability of the Buyer for all claims with respect to the breach of any representations or warranties pursuant to Section 10.2(a) of this Agreement shall not exceed the Cap. Notwithstanding anything contained herein to the contrary, the Parties agree that neither the Basket nor the Cap shall apply to a Party's obligation to indemnify another Party with respect to matters covered by Sections 10.1(b), 10.1(c), 10.2(b) or 10.2(c), as applicable, or to a Party's obligation to indemnify another party pursuant to Sections 10.1(a) or 10.2(a), as applicable, solely with respect to a breach of a representation or warranty relating to Sections 4.1(a), 4.1(b), 4.4(a), or 4.4(b).

ARTICLE XII
MISCELLANEOUS

12.1 Successors and Assigns; Assignment. This Agreement shall not be assignable, in whole or in part, directly or indirectly, by operation of law or otherwise, by either Party without the prior written consent of the other Party, provided that prior to the Closing, Buyer shall have the right to assign its rights and obligations under this Agreement to an Affiliate of Buyer. Subject to the foregoing, this Agreement shall be binding upon, and shall inure to the benefit of the Parties and their respective successors and permitted assigns.

12.2 Notices. All notices, payments and other communications to the Parties under this Agreement must be in writing, and shall be addressed respectively as follows:

Seller: PacifiCorp
c/o Fuels Department
1407 W. North Temple, Suite 110
Salt Lake City, Utah

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Attn: Vice President - Mining and Fuels

With a copy to: Stoel Rives LLP
201 S. Main Street, Suite 1100
Salt Lake City, UT 84111-4904
Attn: Richard R. Hall
Email: rrhall@stoel.com

Buyer: BRC Wellington, LLC
6100 Dutchmans Lane, 11th Floor
Louisville, Kentucky 40205
Attn: Mike Francisco
Email: mfrancisco@bowierefinedcoal.com

All notices shall be given (1) by personal delivery to the Party, (2) by e-mail transmission, with a copy to follow via overnight, certified or registered mail, return receipt requested, or (3) overnight mail or certified or registered mail, return receipt requested. All notices shall be effective and shall be deemed delivered (i) if by personal delivery or e-mail delivery or overnight delivery, on the date of delivery, and (ii) if by certified or registered mail, on the date delivered to the United States Postal Service as shown on the receipt. A Party may change its address from time to time by notice to the other Party.

12.3 Expenses and Fees. Each Party agrees to pay, without right of reimbursement from the other, the costs incurred by it incident to the preparation of this Agreement, and the fees and disbursements of counsel, accountants, and consultants employed by it in connection with the negotiation of this Agreement and the consummation of the transaction contemplated herein.

12.4 Public Announcements. Any public announcement, press release, or similar publicity with respect to this Agreement and the Closing will be issued, if at all, at such time and in such manner as the Parties mutually agree.

12.5 Waiver. Buyer or Seller, by written notice to the other, may: (i) extend a time for performance of any of the obligations or other actions of the other Party under this Agreement; (ii) waive by express written waiver any inaccuracy in the representations or warranties of the other Party contained in this Agreement or any document delivered pursuant to this Agreement; (iii) waive by express written waiver any compliance with the conditions or covenants of the other Party contained in this Agreement; or (iv) waive or modify by express written waiver or agreement performance of any of the obligations performed by the other Party under this Agreement. Except as provided in this section, no action taken pursuant to this Agreement (including without limitation the acts taken at the Closing) shall be deemed to constitute a waiver of compliance with any representations, warranties or covenants contained in

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this Agreement and shall not operate or be construed as a waiver of any subsequent breach of a similar or dissimilar nature.

12.6 Entire Agreement. This Agreement (together with the Schedules and Exhibit(s), and that certain Confidentiality Agreement between the Parties dated November 20, 2013, all of which are incorporated herein and made a part hereof by this reference): (i) supersedes any other agreements, whether written or oral, that may have been made or entered into by any of the Parties hereto (or by any director, officer, or representative of such parties) relating to the matter contemplated hereby; and (ii) constitutes the entire agreement by and between the Parties hereto, and there are no representations, warranties, covenants, agreements, or commitments except as expressly set forth herein.

12.7 Amendments. This Agreement may be amended or supplemented at any time only by an additional written agreement executed by the Parties.

12.8 Severability. Any provision of this Agreement which is unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability, without invalidating the remaining provisions hereof, which provisions shall be enforced to the maximum extent permitted by law and construed so as best to effectuate the provisions hereof, and any such prohibition or unenforceability shall not invalidate or render unenforceable such provision in any other jurisdiction.

12.9 Applicable Law. This Agreement and the legal relations among the Parties shall be governed by and construed in accordance with the substantive laws of the State of Utah without giving effect to the principles of conflict of laws thereof.

12.10 Execution and Counterparts. This Agreement may be executed in two or more counterparts, each which shall be deemed an original, but all of which together shall constitute one and the same agreement.

12.11 Titles and Headings. Titles and headings to paragraphs herein are inserted for convenience of reference only and are not intended to be a part of or to affect the meaning or interpretation of this Agreement.

12.12 Third Parties. Except as provided in Article X, nothing herein expressed or implied is intended or shall be construed to confer upon or give any person or entity other than the Parties and their successors and permitted assigns any right or remedies by reason of this Agreement as a third party beneficiary or otherwise.

12.13 Further Assurances. The Parties agree from time to time to execute such additional documents as are necessary to effect the intent of the Parties as manifested by this Agreement.

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12.14 JURY WAIVER. TO THE FULLEST EXTENT PERMITTED BY LAW, EACH OF THE PARTIES HERETO WAIVES ANY RIGHT IT MAY HAVE TO A TRIAL BY JURY IN RESPECT OF LITIGATION DIRECTLY OR INDIRECTLY ARISING OUT OF, UNDER OR IN CONNECTION WITH THIS AGREEMENT. EACH PARTY FURTHER WAIVES ANY RIGHT TO CONSOLIDATE ANY ACTION IN WHICH A JURY TRIAL HAS BEEN WAIVED WITH ANY OTHER ACTION IN WHICH A JURY TRIAL CANNOT BE OR HAS NOT BEEN WAIVED.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement by their duly authorized representatives the day and year first above written.

SELLER:

PACIFICORP
an Oregon corporation

Cindy A. Crane
President/CEO - PacifiCorp dba Rocky Mountain Power

BUYER:

BRC WELLINGTON, LLC
a Delaware limited liability company

By: DB RC Investments II, LLC, its sole member

By: Bowie Refined Coal, LLC, its manager

By: JAMES J WOLFE
Its: CFO

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Schedule 1
Best of Seller's Knowledge

1. Rick Poulson - General Manager, Deer Creek Mine - Interwest Mining Company
2. Chuck Semborski - Exploration and Geology Manager, Interwest Mining Company
3. Kenneth Fleck - Geology and Environmental Affairs Manager, Interwest Mining Company
4. Scott Child - Manager, Lands & Regulatory Affairs, Interwest Mining Company
5. Dennis Oakley - Senior Mine Engineer, Interwest Mining Company
6. Bret Morgan - Manager, Fuel Supply, PacifiCorp Energy

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Schedule 2
Notice of Violation

None.

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Schedule 3
Permits

1. Volume 10, DOGM Mine Permit C/015/0018
2. Air Quality Approval Order – DAQE-926-91

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Schedule 4
Property Leases

1. Easement for the overhead power line located at the south end of the property near the entrance gate, as depicted on the survey prepared by Johansen & Tuttle dated May 5, 2015 (attached to Schedule 5).

2. Easement for the buried pipeline located at the south end of the property near the entrance gate, as depicted on the survey prepared by Johansen & Tuttle dated May 5, 2015 (attached to Schedule 5).

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Schedule 5
Real Property

That certain parcel of real property located in Emery County, State of Utah, as more particularly described below and generally depicted on the attached map.

PROPERTY DESCRIPTION:

Beginning at the Northeast corner of Section 6, Township 17 South, Range 8 East, SLB&M, and running thence S 89°52'00" W, 1272.00 feet along Section line; thence S 00°08'00" W, 610.00 feet; thence S 83°28'43" E, 302.04 feet; thence S 72°54'35" E, 314.08 feet; thence S 63°06'41" E, 224.51 feet; thence S 48°18'17" E, 268.40 feet; thence S 20°06'29" W, 1066.85 feet; thence S 39°24'03" W, 846.37 feet, more or less to the Northerly right-of-way of SR-31; thence N 89°39'06" E, 139.42 feet along said right-of-way; thence N 43°39'42" E, 1520.19 feet; thence N 31°02'18" E, 412.96 feet; thence N 22°58'45" E, 1322.55 feet to the North line of Section 5, Township 17 South, Range 8 East, SLB&M.; thence N 89°44'10" W, 744.58 feet along Section line to the point of beginning.

Containing 49.05 acres more or less

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Schedule 6
Consents

None.

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Schedule 7
Pending Litigation

None.

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Schedule 8
Hazardous Substances

None.

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Schedule 9
Notices of Default

None.

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PACIFICORP DEER CREEK WASTE SITE

LEE M. SWASEY
PROFESSIONAL LAND SURVEYOR 161934

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APPENDIX 1-2

Certificate of Insurance

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BOWIE-3 OP ID: BH

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 08/23/2016

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Central Insurance Services
4630 Taylorsville Road
Louisville, KY 40220
Robert P. Wessel, Jr. CPCU

CONTACT NAME: Robert P. Wessel, Jr. CPCU
PHONE (A/C, No, Ext): 502-493-2375 FAX (A/C, No): 502-493-2320
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Federal Ins. Co./Chubb	20281
INSURER B : Rockwood Casualty Ins	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
Bowie Refined Coal, LLC
Roy West
6100 Dutchmans Ln Ste 1100
Louisville, KY 40205

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE [X] OCCUR X Emp/Ben ded of $1 GEN'L AGGREGATE LIMIT APPLIES PER: POLICY [ ] PRO-JECT [ ] LOC OTHER:			3588-98-32CHI	02/05/2016	02/05/2017	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG Emp Ben.	$ 1,000,000 $ 1,000,000 $ 10,000 $ 1,000,000 $ 2,000,000 $ 2,000,000 $ 1,000,000
	AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS [ ] SCHEDULED AUTOS HIRED AUTOS [ ] NON-OWNED AUTOS			(13) 7357-91-53	02/05/2016	02/05/2017	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $ $
A	X UMBRELLA LIAB X OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $			7987-5887	02/05/2016	02/05/2017	EACH OCCURRENCE AGGREGATE	$ 5,000,000 $ $
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N [ ] (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		WC455788	02/01/2016	02/01/2017	PER STATUTE OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 1,000,000 $ 1,000,000 $ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
Includes coverage for Wellington - BRC Wellington, LLC at 1865 West Ridge Road, Wellington, UT 84542

CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. INCORPORATED

AUTHORIZED REPRESENTATIVE
Robert P. Wessel Jr

AUG 11 2016

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Division of Oil, Gas & Mining

The ACORD name and logo are registered marks of ACORD

APPENDIX 1-3

Proof of Publication

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AFFIDAVIT OF PUBLICATION

STATE OF UTAH)

ss.

County of Emery,)

I, Jenni Fasselin, on oath, say that I am the Publisher of the Emery County Progress, a weekly newspaper of general circulation, published at Castle Dale, State of Utah and County aforesaid, and that a certain notice, a true copy of which is hereto attached, was published in the full issue of such newspaper for 4 (Four) consecutive issues, and on the Utah legals.com webwsite; the first publication was on the 6th day of October, 2015, and that the last publication of such notice was in the issue of such newspaper dated the 27th day of October, 2015.

Jenni Fasselin

Jenni Fasselin – Publisher

Subscribed and sworn to before me this 27th day of October 2015.

Linda Thayn

Notary Public My commission expires January 10, 2019 Residing at Price, Utah

Publication fee, $ 168.00

LINDA THAYN
NOTARY PUBLIC-STATE OF UTAH
COMMISSION# 680835
COMM. EXP. 01-10-2019

NOTICE OF PERMIT APPLICATION
BRC WELLINGTON LLC

Notice is hereby given that BRC Wellington LLC, 6100 Dutchmans Lane, Suite 900, Louisville, Kentucky 40205 has submitted an application to the Utah Division of Oil, Gas and Mining (the "Division") to recover coal from the Deer Creek waste rock site located approximately 6 miles northwest of Huntington, Utah. The permit area for this facility is located in Sections 5 and 6, Township 18 S., Range 8 E., SLBM and contains approximately 30.92 acres.

The Division has determined that this application is administratively complete. A copy of the permit application is available for public inspection at the following locations:

Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, UT 84114-5801

Written comments, objections, or a request for an informal conference regarding the above application should be directed to the Division at the above address within the next 30 days.

Published in the Emery County Progress October 6, 13, 20 and 27, 2015.

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CHAPTER 2
SOILS

2.10 Introduction

This chapter contains pertinent information relating to identification, management, and reclamation activities associated with the soil resources present in the disturbed area of the Deer Creek waste rock site (the "Deer Creek site" or the "site").

2.20 Environmental Description

The Deer Creek site lies in central Utah near the mouth of Huntington Canyon. The dominant surficial geologic formation at the site is the Mancos Shale, of which the Masuk member is present at the surface. The Masuk member consists of light- to medium-gray marine gypsiferous mudstones. Surface elevations in the permit area range from about 6,240 to about 6,420 feet above mean sea level.

Soils in the area have formed primarily from residual, weathered shale. Soils are typically shallow to very shallow, well drained and consist predominantly of gravelly to cobbly loam, clay loam, and sandy loam. The soil is generally saline with a high erosion hazard (see Section 2.2.2).

2.2.1 Prime Farmland Investigation

Data provided by the Natural Resources Conservation Service Web Soil Survey[1] indicate that prime farmland is not located within the permit area (see Appendix 2-1).

2.2.2 Soil Survey

Soil survey data obtained from the NRCS Web Soil Survey are presented in Appendix 2-1, and are summarized herein. Survey data include the following information: taxonomic classification, typical pedon descriptions, ranges of selected chemical properties, and productivity.

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[1] http://websoilsurvey.nrcs.usda.gov/app/, accessed 20 Jan 2015.

ratings. In addition to the information downloaded from the NRCS web site, Appendix 2-2 contains data from samples collected from the permit area prior to disturbance of the site. These data are summarized below.

2.2.2.1 Soils Map

Figure 2-1 delineates the soil types present in the permit and adjacent areas. Subsequent discussions presented herein are restricted primarily to soil that occurs within the permit area.

2.2.2.2 Soil Identification

According to the NRCS Web Soil Survey, the Deer Creek site is located on soils classified as the Gerst-Strych-Badland complex, 30 to 70 percent slopes. This is further indicated on Figure 2-1.

2.2.2.3 Soil Description

As indicated in Appendix 2-1, the Gerst soil consists of very shallow and shallow, well drained soils. The typical Gerst pedon is described as follows:

A--0 to 5 inches; very pale brown (10YR 7/3) parachannery loam, pale brown (10YR 6/3) moist; weak very fine, fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, and slightly plastic; common fine, very fine, few medium roots; many fine and very fine, common medium pores; 20 percent parachanners; slightly effervescent, (13 percent calcium carbonate equivalent) carbonates are disseminated; moderately alkaline (pH 8.2); abrupt smooth boundary. (1 to 7 inches thick)

C1--5 to 9 inches; pale brown (10YR 6/3) parachannery loam, brown (10YR 5/3) moist; moderate very thin and thin platy geogenic structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine, few medium roots; common very fine and fine pores; 30 percent parachanners; strongly effervescent, (35 percent calcium carbonate equivalent) carbonates are disseminated; moderately alkaline (pH 8.2); clear smooth boundary. (4 to 10 inches thick)

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C2--9 to 13 inches; pale brown (10YR 6/3) parachannery loam; brown (10YR 5/3) moist; weak thick and medium platy geogenic structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 25 percent parachanners; strongly effervescent, (33 percent calcium carbonate equivalent) carbonates are disseminated; moderately alkaline (pH 8.4); clear smooth boundary. (3 to 8 inches thick)

Cr--13 to 23 inches; highly fractured shale.

The Strych soil consists of very deep, well drained, moderately to moderately rapidly permeable soils (see Appendix 2-1). The typical Strych pedon is described as follows:

A--0 to 1 inch; yellowish brown (10YR 5/4) stony fine sandy loam, brown (10YR 4/3) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, and slightly plastic; few very fine roots; common very fine and fine interstitial pores; 10 percent gravel and 5 percent stones on soil surface; slightly calcareous; carbonates are disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (1 to 4 inches thick)

Bw--1 to 6 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine, few medium interstitial pores; 10 percent gravel; slightly calcareous; carbonates are disseminated; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 21 inches thick)

Bk1--6 to 11 inches; pale brown (10YR 6/3) gravelly loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, moderately sticky and slightly plastic; few very fine, fine, and medium tubular pores; 15 percent gravel; 5 percent stones and 5 percent cobbles; moderately calcareous; carbonates are disseminated and as thin coatings on undersides of rock fragments; strongly alkaline (pH 8.6); clear smooth boundary. (4 to 36 inches thick)

Bk2--11 to 25 inches; pale brown (10YR 6/3) very stony loam, brown (10YR 5/3) moist; massive; very hard, firm, slightly sticky and slightly plastic; few very fine, fine, medium and coarse roots; few very fine tubular pores; 20 percent gravel, 15 percent stones, and 5 percent cobbles; strongly calcareous; carbonates are in common fine veins and as coatings on rock fragments; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 55 inches thick)

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Bk3--25 to 48 inches; pale brown (10YR 6/3) very stony loam, yellowish brown (10YR 5/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few fine, medium, and coarse roots; common very fine tubular pores; 20 percent cobbles; 20 percent stones and 5 percent boulders; strongly calcareous, carbonates are in few fine veins and as coatings on rock fragments; strongly alkaline (pH 8.8); clear smooth boundary. (0 to 25 inches thick)

C--48 to 60 inches; light yellowish brown (10YR 6/4) stony sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; 10 percent stone and 5 percent gravel; strongly calcareous, carbonates are disseminated; moderately alkaline (pH 8.4).

The soil survey contains no typical pedon description of Badland soils. However, the map unit description provided in Appendix 2-1 indicates that Badland soil typically consists of 2 inches of clay overlying bedrock. This soil tends to have a very high runoff potential, a high calcium carbonate content, and a high gypsum content. The Badland soil is generally slightly to strongly saline with a moderately high sodium adsorption ratio.

Data provided in Appendix 2-2 were obtained from the Energy West Mining and Reclamation Plan for the site. These data represent analyses of 32 soil samples collected in April 1987 prior to disturbance of the Deer Creek site at the locations shown on Plate 2-1. Based on these data, the soil at the site is slightly to moderately alkaline, with pH values ranging from 7.35 to 8.50 and averaging 7.94. The electrical conductivity of the soil ranges from 0.57 to 17.80 millimhos/cm, averaging 6.84 millimhos/cm. The calcium carbonate content of the soil averages 18.96%, ranging from a low of 4.03% to a high of 47.19%. The sodium adsorption ratio varies widely across the site, averaging 12.03 with a minimum of 0.50 and a maximum of 35.80.

2.2.2.4 Soil Productivity

Under favorable conditions, the NRCS Web Soil Survey indicates that Gerst-Strych-Badland soils can produce only 63 pounds of rangeland vegetation per acre annually. These production values drop to 44 lb/acre/yr under normal and 19 lb/acre/yr under unfavorable conditions (see Appendix 2-1). As a result, these soils are categorized as having a Class 8 capability, which indicates that they have limitations that preclude commercial plant production and restricting their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

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2.2.3 Prime Farmland Soil Characterization

The NRCS Web Soil Survey indicates that soil within the permit area does not qualify as prime farmland.

2.2.4 Substitute Topsoil

Energy West segregated topsoil and subsoil from the site prior to disturbance of the area. Therefore, BRC Wellington ("BRCW") does not propose to use substitute topsoil during reclamation. Since the use of substitute topsoil is not anticipated, no field trials or other tests of suitability are anticipated.

2.30 Operation Plan

2.3.1 General Requirements

2.3.1.1 Removing and Storing Soil Methods

The Deer Creek site has been used for the disposal of waste rock since the late 1980s. Prior to site disturbance, topsoil and subsoil were segregated by Energy West and stored in stockpiles located within the permit area. The approximate depths to which soil was stripped and the locations of the stockpiles in which it was stored are shown on Plate 2-1. Topsoil was placed on the upper foot of the berms, with the remainder of the berms constructed of subsoil.

In areas where additional disturbance occurred due to upgrading the site access road, the upper 6 inches of soil was removed and temporarily stockpiled as topsoil. Subsoil was then graded as needed to form the base for the roadway. Following completion of the subgrade work, the material that was temporarily stockpiled as topsoil was evenly spread over the embankment outslopes. This topsoil was then revegetated and subsequently evaluated for revegetation success (see Appendix 3-2 of this application).

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Topsoil and subsoil will similarly be removed and segregated prior to any new disturbances, if they occur as a result of operations required to recover coal from the Deer Creek site. All soil that is stripped in the future will be segregated into separate stockpiles as subsoil and topsoil.

2.3.1.2 Suitability of Topsoil Substitutes/Supplements

No topsoil substitutes or supplements are planned for use during reclamation of the site.

2.3.1.3 Testing of Topsoil Handling and Reclamation Procedures

During site reclamation, BRCW will exercise care to guard against over-compaction and erosion during and after application of topsoil and will employ the necessary measures to ensure the stability of topsoil on reclaimed areas. Prior to reclamation, BRCW will inspect soil stockpiles at least annually and fill, regrade, or otherwise stabilize any rills or gullies deeper than 9 inches which form in the stockpiles. The areas adjacent to any rills or gullies which have been filled, regraded, or otherwise stabilized will be reseeded or stabilized appropriately.

2.3.1.4 Construction, Modification, Use, and Maintenance of Topsoil Stockpiles

The subsoil/topsoil stockpiles at the site were constructed by Energy West prior to other disturbance of the site. Surveys indicate that the stockpiles contain approximately 33,900 cubic yards of subsoil and 2,300 cubic yards of topsoil stripped from the area prior to placing waste rock. These stockpiles are divided as shown on Plate 2-1. The stockpiled materials were placed on stable surfaces and protected from off-pile erosion through the installation of silt fences. Markers have been placed on the piles to indicate that they contain topsoil. It is not anticipated that stockpiled topsoil will be moved or disturbed again until required for redistribution during final reclamation.

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2.3.2 Topsoil and Subsoil Removal

2.3.2.1 Topsoil Removal and Segregation

If additional soil disturbances occur at the site, all topsoil thicker than 6 inches will be removed prior to disturbance, segregated, and stockpiled. Topsoil less than 6 inches thick will be removed according to Section 2.3.2.3.

2.3.2.2 Poor Topsoil

Topsoil that is of an insufficient quantity or of sufficiently poor quality (for sustaining vegetation) will be removed as a separate layer and segregated. Such operations will be done with approval of the Division of Oil, Gas and Mining and in compliance with R614-301-233.100.

2.3.2.3 Thin Topsoil

Topsoil to be removed that is less than 6 inches thick will be removed with the immediately underlying unconsolidated materials. This material mixture will be treated as topsoil.

2.3.2.4 Minor Disturbances Not Requiring Topsoil Removal

Small Structures. Topsoil will not be removed prior to construction resulting in only minor disturbances. Such construction activities may include work on small structures such as power poles, signs, fence lines, and other small structures.

Vegetation. BRCW will not remove topsoil for minor disturbances where such activity will not destroy vegetation or cause erosion.

2.3.2.5 Subsoil Segregation

Due to the poor quality of soil at the site, the B and C soil horizons will not be individually segregated and stockpiled.

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2.3.2.6 Timing

Soil removal will take place after all vegetation has been removed that could interfere with soil salvage. Future removal of soil intended for site reclamation will occur prior to other surface disturbance activities.

2.3.2.7 Topsoil and Subsoil Removal Under Adverse Conditions

In areas of future surface disturbance where sufficient topsoil is present, topsoil and subsoil will be removed separately and segregated, except where natural conditions render such operations hazardous.

Conventional Machines. In localities where steep grades, adverse terrains, severe rockiness, limited depth of soils, or other adverse conditions exist that render soil removal and segregation activities using conventional machines hazardous, soils will not be salvaged and stockpiled.

Substitute Topsoil. Importing of substitute topsoil is not anticipated at this site.

2.3.3 Topsoil Substitutes and Supplements

2.3.3.1 Overburden Materials Supplementing and/or Replacing Topsoil

No overburden materials will be used in site reclamation.

2.3.3.2 Suitability of Topsoil Substitutes and Supplements

No topsoil substitutes or supplements are planned for use at the site.

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2.3.3.3 Physical and Chemical Analyses

No topsoil substitutes or supplements are planned for use at the site. Hence, no physical or chemical analyses of substitute material are anticipated.

2.3.3.4 Testing of Substitute Topsoil

Since it will not be used at the site, no testing of substitute topsoil is anticipated.

2.3.4 Topsoil Storage

2.3.4.1 Topsoil Stockpiling

Topsoil that was removed from the area during site grading is stored in the upper 12 inches of the on-site stockpiles shown on Plate 2-1. Any topsoil removed from the site in the future will be stockpiled for later use in reclamation operations when it is impractical to promptly redistribute the topsoil on regraded areas.

2.3.4.2 Stockpiled Topsoil

Stable Stockpile Site. The topsoil removed from the site is stored in the stockpiles shown on Plate 2-1. These stockpiles were located in a stable area. Future stockpiles (if any) will be similarly located in stable areas.

Protection from Contaminants and Compaction. Stockpiled topsoil is located in areas away from traffic that might introduce contaminants and unnecessary compaction. Future stockpiles (if any) will be similarly located in protected areas.

Wind and Water Erosion Protection. The topsoil stockpiles are protected from wind and water erosion by silt fences that have been installed at the base of the stockpiles. Vegetative covers have also been established to the extent allowed by the poor quality of the soil. Future stockpiles (if any) will be similarly protected.

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Topsoil Redistribution. No stockpiled topsoil will be moved until redistributed during reclamation operations unless approved by DOGM.

2.3.4.3 Topsoil Stockpile Relocation

Stockpiled topsoil in jeopardy of being detrimentally affected in terms of its quantity and quality by site operations may be temporarily relocated if approved by the Division.

Host Site. Topsoil relocation may occur provided that such action does not permanently adversely affect topsoil of the host site.

Topsoil Suitability. Topsoil relocation may occur provided the topsoil is retained in a condition more suitable for redistribution than if stockpiled.

2.40 Reclamation Plan

2.4.1 General Requirements

Topsoil redistribution, amendments, and stabilization are discussed below.

2.4.2 Soil Redistribution

2.4.2.1 Soil Redistribution Practices

Following recovery of coal from the waste rock to the extent feasible, all disturbed areas will be reclaimed. As indicated in Section 2.3.1.1, the upper foot of the soil stockpile berms consists of topsoil. For any section of the stockpile planned for soil removal, the topsoil will first be scraped from the stockpile using dozers, loaders, or trackhoes. This topsoil will be temporarily stored within the disturbed area at a location that will not receive traffic. The subsoil will then be removed and placed on the prepared surface, following which the recently-scraped topsoil will be placed.

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The subsoil and topsoil will be redistributed from the stockpiles in a manner that achieves a stable thickness consistent with the post-mining land use, contours, and surface-water drainage systems. When placing topsoil, track-mounted equipment will be used where feasible to prevent excess compaction of the materials. Due to the high clay content and sodicity of the soils, no redistribution of topsoil will occur when the soil is too wet to adequately handle. The redistributed topsoil will be roughened during redistribution and prior to revegetation to protect the material from wind and water erosion before and after seeding.

2.4.2.2 Regrading

Regraded areas will be scarified before redistribution of topsoil to reduce potential slippage of the redistributed material and to promote root penetration.

2.4.2.3 Topsoil Redistribution on Impoundments and Roads

No on-site storm water impoundments or roads will be left in place after site reclamation.

2.4.3 Soil Nutrients and Amendments

Fertilizer will be applied by broadcasting or as a separate operation of hydroseeding in conjunction with topsoil redistribution and revegetation. This fertilizer will consist of:

- Ammonium nitrate (applied at a rate of 50 lb/acre)
- Triple superphosphate (applied at a rate of 75 lb/acre)

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2.4.4 Soil Stabilization

2.4.4.1 Protection and Stabilization of Surface Areas

Two practices will be implemented to control erosion and air pollution attendant to erosion during site reclamation. First, during redistribution of subsoil and topsoil, the area of newly

exposed stockpile surfaces will be minimized to the extent feasible. Second, redistributed topsoil will be roughened as it is placed prior to final revegetation. This roughening will minimize the distance that runoff can travel and will also create small depressions that will hold water and enhance the potential for revegetation success.

2.4.4.2 Mulch Application

Mulch will be applied to the redistributed topsoil either in the form of hydromulch or shredded alfalfa hay mulch. If used, hay mulch materials will only be obtained from fields that are certified by the County Extension Agent as noxious weed free.

If hydromulch is used, it will be applied to the surface of the topsoil at a rate of at least 2,000 lb/acre with an added tackifier. If alfalfa hay mulch is used, it will be applied at a rate of 4,000 lb/acre and mechanically crimped into the soil.

2.4.4.3 Rills and Gullies

Surface roughening of the redistributed topsoil will greatly minimize the potential for rills and gullies to form following reclamation. However, rills and gullies that form in areas that have been regraded and topsoiled will be filled, regraded, or otherwise stabilized. As required, topsoil in these areas will be replaced and the areas will be reseeded.

2.50 Performance Standards

2.5.1 Topsoil, Subsoil, and Topsoil Supplements Management

All topsoil, subsoil, and topsoil supplements will be managed as outlined in Sections 2.30 and 2.40.

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2.5.2 Stockpiled Topsoil and Subsoil

All stockpiled topsoil and subsoil will be managed according to plans outlined in Sections 2.30 and 2.40.

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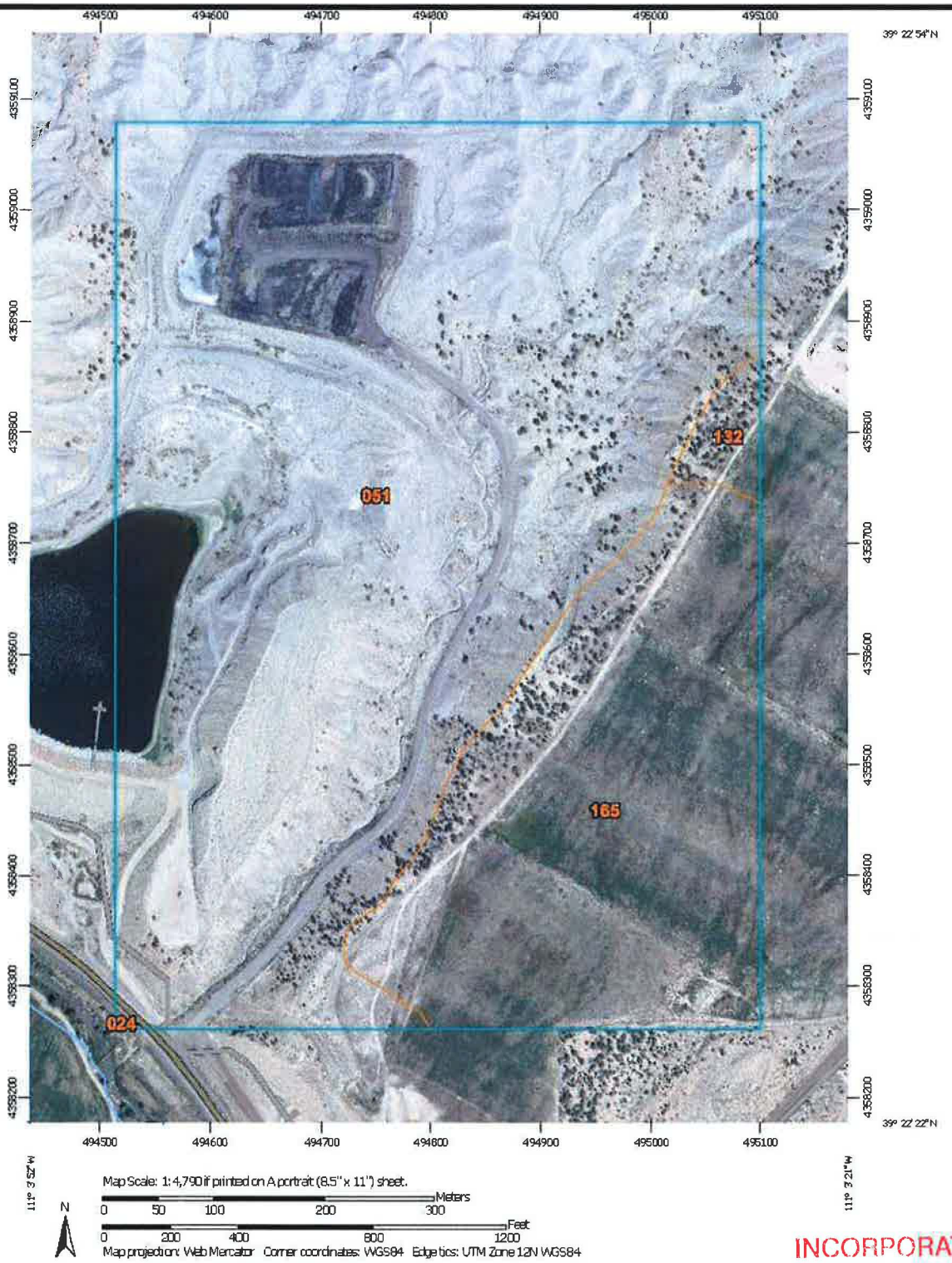

LEGEND

024	Castledale–Colorow–Pherson complex, 1 to 5 percent slopes.
051	Gerst–Strych–Badland complex, 30 to 70 percent slopes.
132	Porser very stony fine sandy loam, 3 to 20 percent slopes.
165	Strych very stony fine sandy loam, 3 to 30 percent slopes.

SOURCE:
NRCS WEB SOIL SURVEY ACCESSED 20 JAN, 2015

FIGURE 2–1. SOILS MAP

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EarthFax

G:\UC14 05 - Deer Creek waste rock\Draft MRP\DWG\FIGURE 2-1.dwg, 2/4 15 11:48:25 AM

APPENDIX 2-1

NRCS Soil Survey Information

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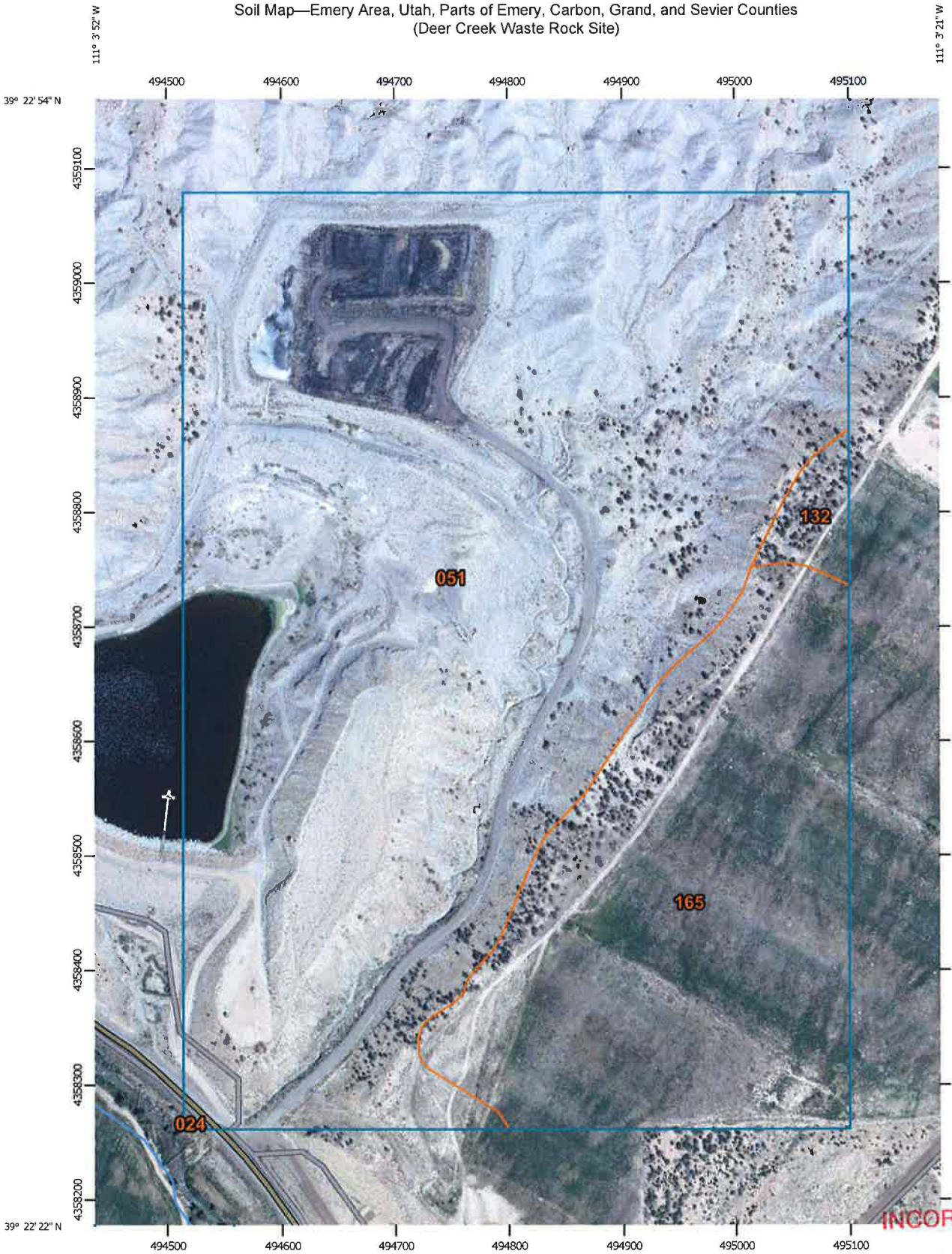
Soil Map—Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
(Deer Creek Waste Rock Site)



Map Scale: 1:4,790 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

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MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
Survey Area Data: Version 4, Aug 8, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2011—Sep 28, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Map Unit Legend

Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties (UT623)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
024	Castledale-Colorow-Pherson complex, 1 to 5 percent slopes	0.0	0.0%
051	Gerst-Strych-Badland complex, 30 to 70 percent slopes	86.5	72.8%
132	Porser very stony fine sandy loam, 3 to 20 percent slopes	1.6	1.3%
165	Strych very stony fine sandy loam, 3 to 30 percent slopes	30.7	25.9%
Totals for Area of Interest		**118.8**	**100.0%**

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Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties

051—Gerst-Strych-Badland complex, 30 to 70 percent slopes

Map Unit Setting

National map unit symbol: jyd5
Elevation: 5,100 to 8,050 feet
Mean annual precipitation: 9 to 12 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Gerst and similar soils: 40 percent
Strych and similar soils: 25 percent
Badland: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gerst

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and/or slope alluvium over residuum weathered from sandstone and shale

Typical profile

A - 0 to 5 inches: very stony loam
C - 5 to 12 inches: clay loam
Cr - 12 to 22 inches: bedrock

Properties and qualities

Slope: 30 to 70 percent
Percent of area covered with surface fragments: 10.0 percent
Depth to restrictive feature: 8 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)

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Sodium adsorption ratio, maximum in profile: 9.0
Available water storage in profile: Very low (about 1.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8e
Hydrologic Soil Group: D
Ecological site: Semidesert very steep shallow clay (utah juniper) (R034XY255UT)

Description of Strych

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Alluvium derived from limestone, sandstone, and shale

Typical profile

A - 0 to 3 inches: very cobbly fine sandy loam
Bw - 3 to 11 inches: very cobbly fine sandy loam
Bk1 - 11 to 20 inches: very cobbly fine sandy loam
Bk2 - 20 to 35 inches: very cobbly sandy loam
C - 35 to 60 inches: very gravelly fine sandy loam

Properties and qualities

Slope: 30 to 70 percent
Percent of area covered with surface fragments: 15.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 45 percent
Gypsum, maximum in profile: 3 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 6.0
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: Semidesert very steep loam (utah juniper - pinyon) (R034XY253UT)
Other vegetative classification: Semidesert Stony Loam (Utah Juniper-Pinyon) (034XY247UT_2)

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Description of Badland

Setting

Landform: Erosion remnants, hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shale and siltstone

Typical profile

C - 0 to 2 inches: clay
Cr - 2 to 12 inches: bedrock

Properties and qualities

Slope: 45 to 80 percent
Depth to restrictive feature: 0 to 2 inches to paralithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 10 percent
Salinity, maximum in profile: Very slightly saline to strongly saline (4.0 to 20.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 30.0
Available water storage in profile: Very low (about 0.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D

Minor Components

Molen

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Semidesert loam (salina wildrye) (R034XY209UT)

Rock outcrop

Percent of map unit: 5 percent
Landform: Cliffs, erosion remnants, escarpments, ledges
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Gerst

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex

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Ecological site: Semidesert very steep shallow clay (utah juniper) (R034XY255UT)

Rubble land

Percent of map unit: 2 percent
Landform: Talus slopes
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Data Source Information

Soil Survey Area: Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
Survey Area Data: Version 4, Aug 8, 2014

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LOCATION GERST UT+WY

Established Series
Rev GWL/CSW/JWB
04/2011

GERST SERIES

The Gerst series consists of very shallow and shallow, well drained soils that formed in slope alluvium and colluvium over residuum derived from shale and sandstone. Gerst soils are on hillslopes, cuestas, hills, mountain slopes and escarpments on structural benches. Slopes range from 2 to 70 percent. Mean annual precipitation is about 10 inches and the mean annual temperature is about 45 degrees F.

TAXONOMIC CLASS: Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents

TYPICAL PEDON: Gerst parachannery loam, on a northwest facing, convex-concave, 6 percent slope in black sagebrush-shadscale rangeland at an elevation of 6,320 feet. (Colors are for air-dry soil unless otherwise noted) The surface is covered by 55 percent angular parachanners.

A--0 to 5 inches; very pale brown (10YR 7/3) parachannery loam, pale brown (10YR 6/3) moist; weak very fine, fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, and slightly plastic; common fine, very fine, few medium roots; many fine and very fine, common medium pores; 20 percent parachanners; slightly effervescent, (13 percent calcium carbonate equivalent) carbonates are disseminated; moderately alkaline (pH 8.2); abrupt smooth boundary. (1 to 7 inches thick)

C1--5 to 9 inches; pale brown (10YR 6/3) parachannery loam, brown (10YR 5/3) moist; moderate very thin and thin platy geogenic structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine, few medium roots; common very fine and fine pores; 30 percent parachanners; strongly effervescent, (35 percent calcium carbonate equivalent) carbonates are disseminated; moderately alkaline (pH 8.2); clear smooth boundary. (4 to 10 inches thick)

C2--9 to 13 inches; pale brown (10YR 6/3) parachannery loam; brown (10YR 5/3) moist; weak thick and medium platy geogenic structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 25 percent parachanners; strongly effervescent, (33 percent calcium carbonate equivalent) carbonates are disseminated; moderately alkaline (pH 8.4); clear smooth boundary. (3 to 8 inches thick)

Cr--13 to 23 inches; highly fractured shale.

TYPE LOCATION: Uintah County, Utah; about 20 miles southwest of Ouray; 1,200 feet north and 100 feet west of the southeast corner of sec. 12, T. 13 S., R. 18 E., SLBM; Dog Knoll, Utah USGS quad. Latitude 39 degrees 41 minutes 46 seconds N. and longitude 109 degrees 50 minutes 31 seconds W. NAD 27.

RANGE IN CHARACTERISTICS:

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Soil moisture: The soil moisture control section is affected by precipitation that peaks from July to October and falls evenly throughout the remainder of the year; aridic moisture regime bordering on ustic
Mean annual soil temperature: 47 to 52 degrees F.
Depth to paralithic contact: 6 to 20 inches to weathered bedrock

Particle-size control section:
Clay content: 18 to 35 percent clay
Rock fragments: 15 to 35 percent indurated and/or parafragments
Gypsum content: 0 to 5 percent

A horizon:
Hue: 10YR to 5Y
Value: 5 to 7 dry, 3 to 6 moist
Chroma: 2 to 4 dry or moist
Texture: gravelly loam, parachannery loam, channery loam, very stony loam, extremely stony loam, very channery loam, cobbly loam, loam, very bouldery loam, very cobbly clay loam
Reaction: moderately alkaline or strongly alkaline

C horizon:
Hue: 10YR to 5Y
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 1 to 4 dry or moist
Texture: loam, clay loam, parachannery clay loam, parachannery silt loam, parachannery loam, channery loam, parachannery clay loam, channery clay loam or parachannery silty clay loam
Reaction: moderately alkaline or strongly alkaline.

COMPETING SERIES: These are the Canyon (NE), Epping (NE), Eslendo (NM), Picante (CO), Quarteles (NM), Redarrow (WY), Remorris (UT), Sandoval (NM), Shingle (WY), Simel (UT), Taluce (WY), Tassel (NE) and Tesihim (AZ)(T) series.
Canyon, Epping, Eslendo, Picante, Sandoval and Shingle soils have less than 15 percent rock fragments in the particle-size control section.
Quarteles, Redarrow, Remorris and Simel soils have hue of 7.5YR or redder.
Taluce, Tassel and Tesihim soils contain less than 18 percent clay in the particle-size control section.

GEOGRAPHIC SETTING:
Parent material: slope alluvium and colluvium over residuum derived from shale and sandstone
Landform: structural benches, mesas, terraces, cuestas, mountain slopes and hillslopes
Slopes: 2 to 70 percent
Elevation: 4,600 to 7,000 feet
Mean annual air temperature: 44 to 50 degrees F.
Mean annual precipitation: 8 to 14 inches
Frost-free period: 110 to 150 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Denco, Mikim, Milok, and Strych soils
Denco soils are on hillslopes, have a fine particle-size control section and are moderately deep
Mikim, Milok , and Strych soils are on alluvial flats and fan remnants and very deep

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DRAINAGE AND PERMEABILITY: Well drained; high runoff; moderate or moderately slow

permeability.

USE AND VEGETATION: The major uses are rangeland, wildlife habitat, and recreation. Potential native vegetation is black sagebrush, shadscale, bluegrass, Utah juniper, and pinyon. This soil has been correlated to the Semidesert Shallow Loam (Utah Juniper-Pinyon) - 034XY227UT range site at the type location in Utah.

DISTRIBUTION AND EXTENT: Northeastern and central Utah. LRR D, MLRA 34B. This soil is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Carbon County, Utah, 1983.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon: the zone from the surface to 5 inches (A horizon).

Paralithic contact: the contact with fractured shale at 13 inches (Cr horizon).

The cation exchange activity class was inferred from laboratory data in the Uintah Area Soil Survey.

Taxonomic version: Eleventh Edition, 2010.

National Cooperative Soil Survey
U.S.A.

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LOCATION STRYCH UT+AZ CO NM WY

Established Series
Rev. DTH/CSW/JWB
04/2011

STRYCH SERIES

The Strych series consists of very deep, well drained, moderately or moderately rapidly permeable soils that formed in mixed alluvium and colluvium derived from sandstone, shale and conglomerate. Strych soils are on fan piedmonts, highly dissected alluvial fans, fan remnants, hill toeslopes, and footslopes of cuestas, mesas, terraces, and escarpments on structural benches. Slopes are 1 to 70 percent. The average annual precipitation is about 11 inches, and the mean annual temperature is about 48 degrees.

TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, mesic Ustic Haplocalcids

TYPICAL PEDON: Strych stony fine sandy loam--rangeland. (Colors are for air-dry soil unless otherwise stated)

A--0 to 1 inch; yellowish brown (10YR 5/4) stony fine sandy loam, brown (10YR 4/3) moist; weak thin platy structure; slightly hard, very friable, slightly sticky, and slightly plastic; few very fine roots; common very fine and fine interstitial pores; 10 percent gravel and 5 percent stones on soil surface; slightly calcareous; carbonates are disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (1 to 4 inches thick)

Bw--1 to 6 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine, few medium interstitial pores; 10 percent gravel; slightly calcareous; carbonates are disseminated; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 21 inches thick)

Bk1--6 to 11 inches; pale brown (10YR 6/3) gravelly loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, moderately sticky and slightly plastic; few very fine, fine, and medium tubular pores; 15 percent gravel; 5 percent stones and 5 percent cobbles; moderately calcareous; carbonates are disseminated and as thin coatings on undersides of rock fragments; strongly alkaline (pH 8.6); clear smooth boundary. (4 to 36 inches thick)

Bk2--11 to 25 inches; pale brown (10YR 6/3) very stony loam, brown (10YR 5/3) moist; massive; very hard, firm, slightly sticky and slightly plastic; few very fine, fine, medium and coarse roots; few very fine tubular pores; 20 percent gravel, 15 percent stones, and 5 percent cobbles; strongly calcareous; carbonates are in common fine veins and as coatings on rock fragments; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 55 inches thick)

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Bk3--25 to 48 inches; pale brown (10YR 6/3) very stony loam, yellowish brown (10YR 5/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few fine, medium, and coarse roots; common very fine tubular pores; 20 percent cobbles; 20 percent stones and 5 percent boulders; strongly calcareous, carbonates

are in few fine veins and as coatings on rock fragments; strongly alkaline (pH 8.8); clear smooth boundary. (0 to 25 inches thick)

C--48 to 60 inches; light yellowish brown (10YR 6/4) stony sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; 10 percent stone and 5 percent gravel; strongly calcareous, carbonates are disseminated; moderately alkaline (pH 8.4).

TYPE LOCATION: Grand County, Utah, about 2 miles northeast of the mouth of Nash Wash Canyon in the Book Cliffs, about 500 feet south and 2,500 feet west of the northeast corner of sec. 11, T. 20 S., R. 21 E.; Calf Canyon USGS quad; lat. 39 degrees 5 minutes 10 seconds N. and long. 109 degrees 33 minutes 59 seconds W., NAD 27.

RANGE IN CHARACTERISTICS:

Soil moisture: soils are dry 50 to 65 percent of the time cumulative when the soil temperature is greater than 41 degrees F. but are not moist for 90 consecutive days when the soil temperature is greater than 47 degrees F. The moist period occurs during the first 4 months following the summer solstice. Aridic moisture regime bordering on ustic.

Mean annual soil temperature is about - 47 to 52 degrees F.

Depth to calcic horizon - 7 to 39 inches

Particle-size control section (weighted average):
Clay content: 6 to 18 percent
Rock fragments: 35 to 75 percent.

A horizon
Hue: 5YR to 10YR.
Value: 4 or 6 dry, 3 to 5 moist,
Chroma: 3 to 6 dry or moist.
Reaction: slightly alkaline, to strongly alkaline.

Bw horizon
Hue: 5YR to 10YR.
Value: 4 to 6 dry or moist
Chroma: 3 to 6 dry or moist.
Texture: fine sandy loam, gravelly fine sandy loam, cobbly fine sandy loam, stony fine sandy loam, cobbly loam, very stony sandy clay loam, very stony loam, very cobbly fine sandy loam or very stony fine sandy loam
Reaction: moderately alkaline or strongly alkaline.

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Bk horizon
Hue: 7.5YR to 10YR
Value: 4 to 8 dry
Chroma: 2 to 8 dry or moist
Texture: very stony loam, gravelly fine sandy loam, very gravelly fine sandy loam, very gravelly sandy loam, very cobbly loam, very cobbly fine sandy loam, cobbly fine sandy loam, very stony fine sandy loam,

extremely cobbly sandy loam, extremely cobbly fine sandy loam, very cobbly sandy loam, gravelly loam, extremely gravelly loam and very stony sandy loam.
Reaction: slightly alkaline to very strongly alkaline
Calcium carbonate equivalents: 8 to 45 percent; control section averages less than 40 percent

BCky or Bky horizon, where present
Hue: 5YR to 10YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 6 dry and moist
Texture: very gravelly fine sandy loam, very cobbly loam, gravelly fine sandy loam
Reaction: slightly alkaline to strongly alkaline
Calcium carbonate equivalent: 10 to 30 percent
Gypsum content: 1 to 4 percent

C horizon, where present
Hue: 5YR to 10YR
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 3 to 6 dry or moist
Texture: stony sandy loam, gravelly fine sandy loam very cobbly loam, extremely cobbly clay loam, very gravelly fine sandy loam
Reaction: slightly alkaline to strongly alkaline
Calcium carbonate equivalent: 5 to 25 percent
Gypsum content: 0 to 4 percent

COMPETING SERIES: These are the Buffcreek (WY), Clapper (UT), Claprych (WY), Ildefonso (NM), Placitas (NM), Raydawn (NM) and Seis (NM) series.
Buffcreek soils have calcic horizon at 3 to 9 inches.
Clapper soils have 18 to 27 percent clay in the particle-size control section.
Buffcreek and Claprych soils have a different moisture pattern affecting the soil moisture control section; moist during May and late June and dry during July, August and September.
Ildefonso soils are moist in some part at least 25 percent of the time the soil temperature exceeds 41 degrees F. The driest month is November and contain Bw horizon.
Placitas and Seis soils are less than 40 inches deep to bedrock or paralithic contact.
Raydawn soils overlie shale-derived residuum and have hue 2.5YR in the substratum.

GEOGRAPHIC SETTING: Strych soils are on fan piedmonts, highly dissected alluvial fans, fan remnants, hill toeslopes, and footslopes of cuestas, mesas, terraces, and escarpments on structural benches. Slopes are 1 to 70 percent. These soils formed in mixed alluvium and colluvium from sandstone, shale, and conglomerate. Some areas have a mantle of basalt fragments up to boulder size as volcanic bombs on the soil surface and extending into the cambic horizon. Elevations range from 4,500 to 9,000 feet. Mean annual air temperature is 45 to 50 degrees F. and the average annual precipitation is 9 to 13 inches. The precipitation is distributed evenly throughout the year with a slight increase in July, August, September, and October. The driest months are April, May and June. The freeze-free period is about 100 to 160 days. At elevations above 7,000 feet Strych soils are mainly on south facing slopes.

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GEOGRAPHICALLY ASSOCIATED SOILS: These are the Barx and Shalako soils.
Barx soils have an argillic horizon and do not have rock fragments in the particle-size control section.
Shalako soils have bedrock within 20 inches of the surface.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate or moderately rapid permeability; moderately high or high saturated hydraulic conductivity.

USE AND VEGETATION: Used mainly for rangeland. The potential vegetation is Utah juniper, Salina wildrye, Indian ricegrass, and needleandthread.

DISTRIBUTION AND EXTENT: Eastern Utah, northern Arizona, northwest New Mexico, and western Colorado and southwestern Wyoming. The series is of moderate extent. MLRAs 34A, 34B, 35 & 36. In the future the Strych series will be limited to Central and North Eastern Utah with the MAST: 47 to 52 degrees F., MAP: 9 to 13 inches, and FFP: 100 to 160, jwb 04/2011.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Henry Mountains Area, Utah, 1985.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Series control section - the zone from 0 to 59 inches (150 cm)

Ochric epipedon - the zone from the surface of the soil to 1 inch. (A horizon)

Cambic horizon - the zone from 1 to 11 inches. (Bw, Bk1 horizons)

Calcic horizon - the zone from 11 to 48 inches. (Bk1, Bk2, Bk3 horizons)

Classified according to Keys to Soil Taxonomy Eleventh Edition, 2010.

Ownership was transferred from Phoenix, Arizona to Lakewood, Colorado, 04/2011.

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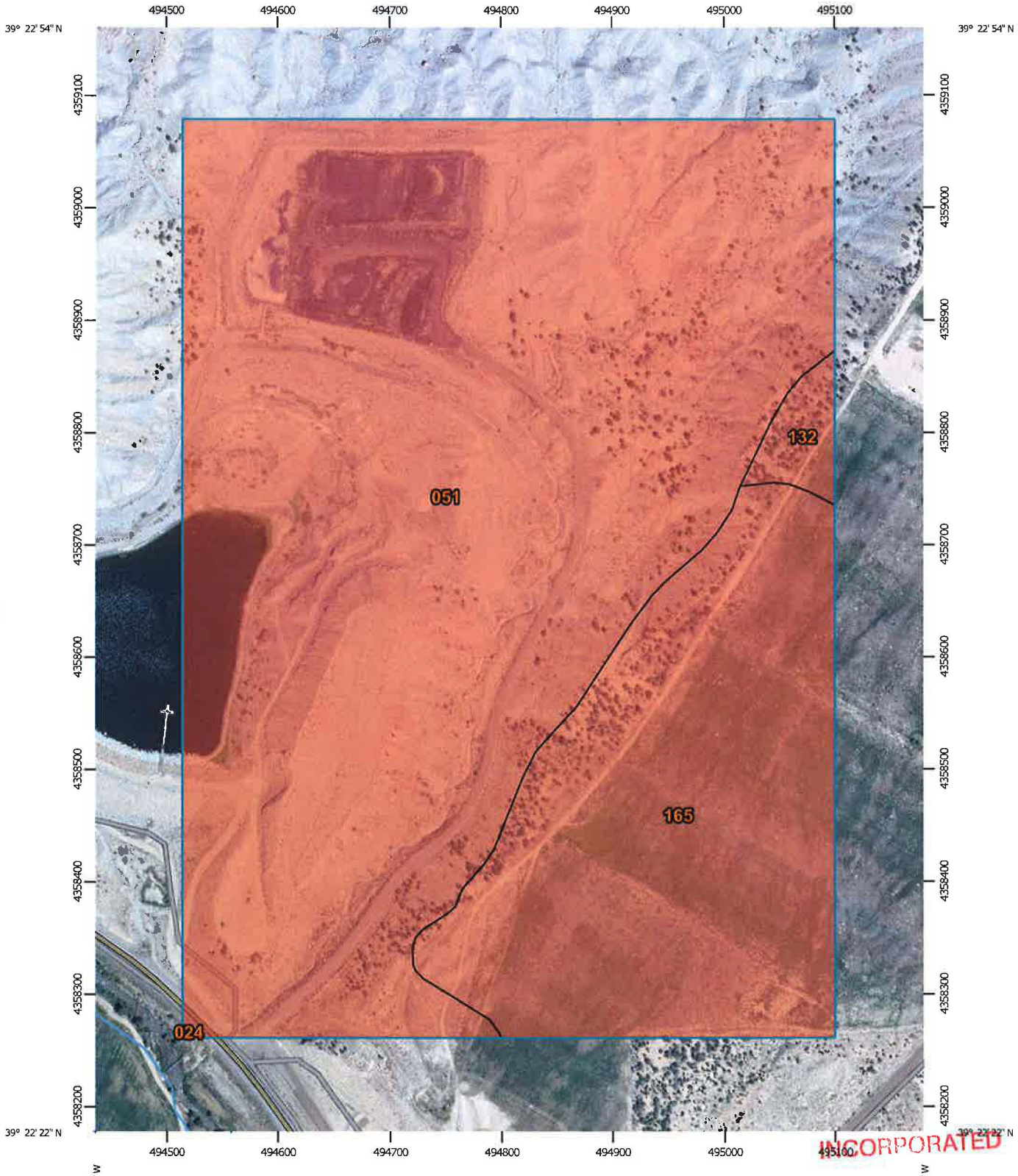
Farmland Classification---Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
(Deer Creek Waste Rock Site)



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MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

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MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
Survey Area Data: Version 4, Aug 8, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2011—Sep 28, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Farmland Classification

Farmland Classification— Summary by Map Unit — Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties (UT623)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
024	Castledale-Colorow-Pherson complex, 1 to 5 percent slopes	Not prime farmland	0.0	0.0%
051	Gerst-Strych-Badland complex, 30 to 70 percent slopes	Not prime farmland	86.5	72.8%
132	Porser very stony fine sandy loam, 3 to 20 percent slopes	Not prime farmland	1.6	1.3%
165	Strych very stony fine sandy loam, 3 to 30 percent slopes	Not prime farmland	30.7	25.9%
Totals for Area of Interest			**118.8**	**100.0%**

Description

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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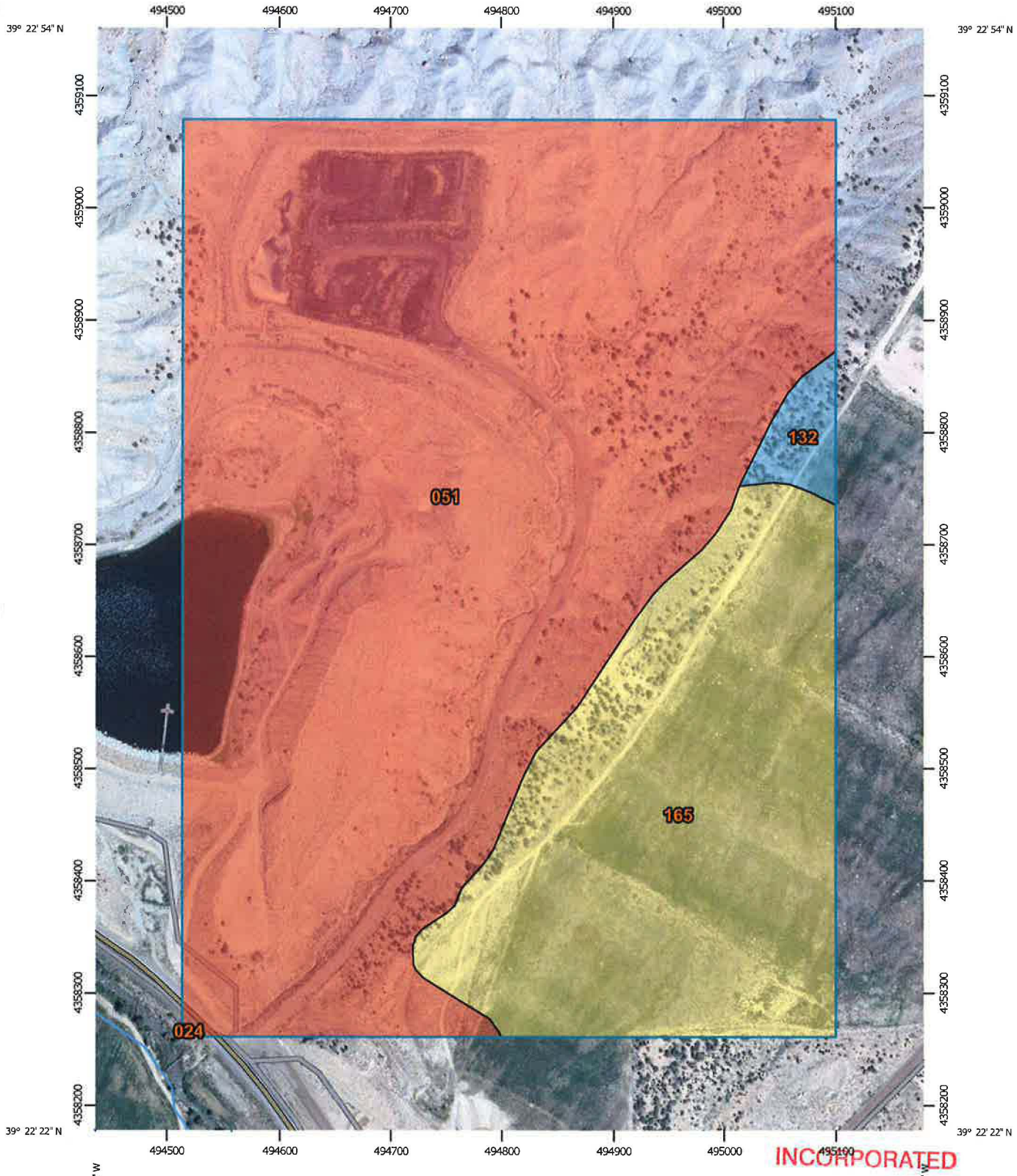
Range Production (Favorable Year)—Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
(Deer Creek Waste Rock Site)



Map Scale: 1:4,790 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

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MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- <= 63
- > 63 and <= 727
- > 727 and <= 998
- > 998 and <= 2285
- Not rated or not available

Soil Rating Lines
- <= 63
- > 63 and <= 727
- > 727 and <= 998
- > 998 and <= 2285
- Not rated or not available

Soil Rating Points
- <= 63
- > 63 and <= 727
- > 727 and <= 998
- > 998 and <= 2285
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
Survey Area Data: Version 4, Aug 8, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2011—Sep 28, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Range Production (Favorable Year)

Range Production (Favorable Year)— Summary by Map Unit — Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties (UT623)				
Map unit symbol	**Map unit name**	**Rating (pounds per acre per year)**	**Acres in AOI**	**Percent of AOI**
024	Castledale-Colorow-Pherson complex, 1 to 5 percent slopes	2285	0.0	0.0%
051	Gerst-Strych-Badland complex, 30 to 70 percent slopes	63	86.5	72.8%
132	Porser very stony fine sandy loam, 3 to 20 percent slopes	998	1.6	1.3%
165	Strych very stony fine sandy loam, 3 to 30 percent slopes	727	30.7	25.9%
Totals for Area of Interest			**118.8**	**100.0%**

Description

Total range production is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. Yields are adjusted to a common percent of air-dry moisture content.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Rating Options

Units of Measure: pounds per acre per year

Aggregation Method: Weighted Average

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Interpret Nulls as Zero: Yes

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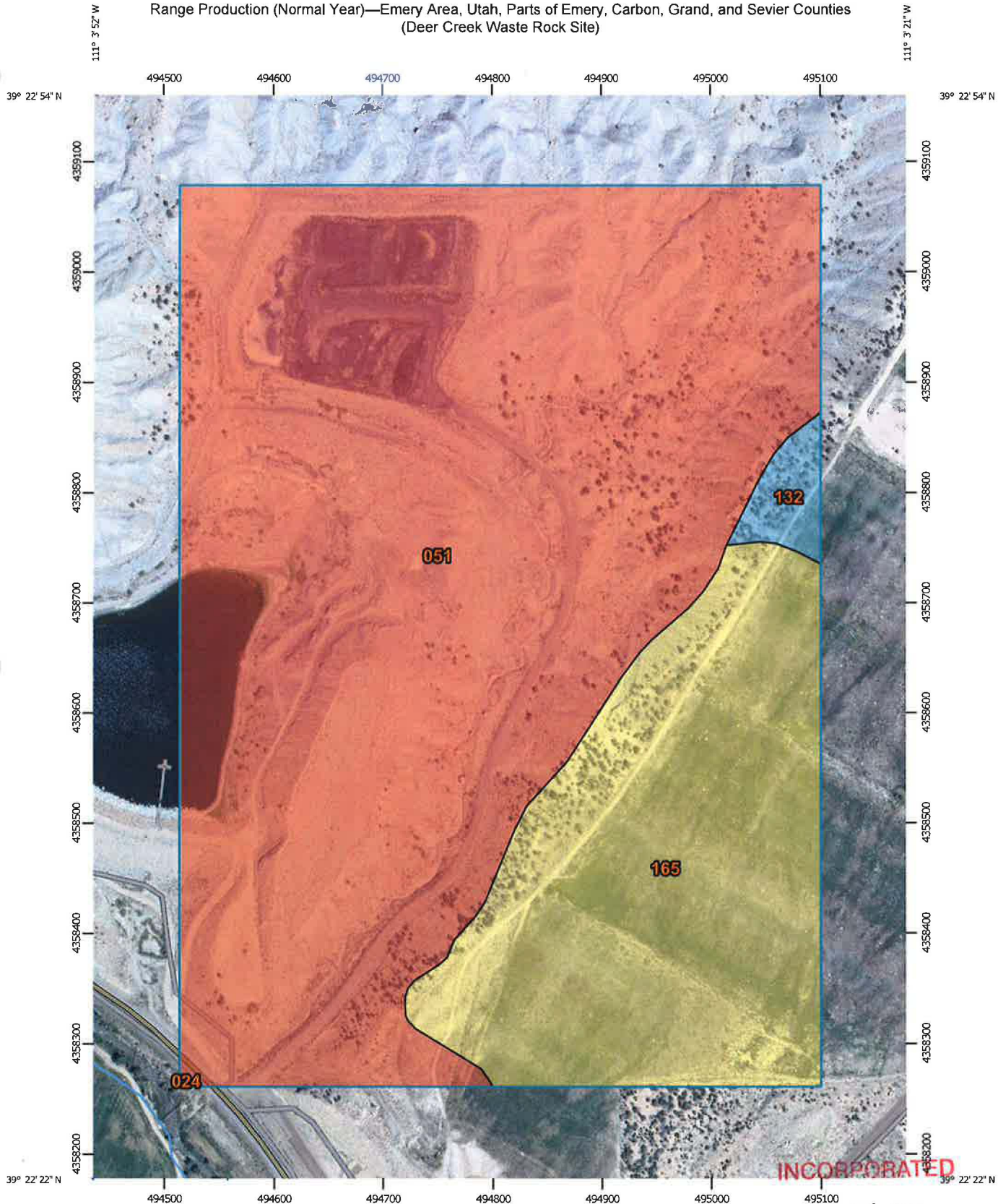
Range Production (Normal Year)—Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
(Deer Creek Waste Rock Site)



Map Scale: 1:4,790 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

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MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- <= 44
- > 44 and <= 525
- > 525 and <= 753
- > 753 and <= 1517
- Not rated or not available

Soil Rating Lines
- <= 44
- > 44 and <= 525
- > 525 and <= 753
- > 753 and <= 1517
- Not rated or not available

Soil Rating Points
- <= 44
- > 44 and <= 525
- > 525 and <= 753
- > 753 and <= 1517
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
Survey Area Data: Version 4, Aug 8, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2011—Sep 28, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Range Production (Normal Year)

Range Production (Normal Year)— Summary by Map Unit — Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties (UT623)				
Map unit symbol	**Map unit name**	**Rating (pounds per acre per year)**	**Acres in AOI**	**Percent of AOI**
024	Castledale-Colorow-Pherson complex, 1 to 5 percent slopes	1517	0.0	0.0%
051	Gerst-Strych-Badland complex, 30 to 70 percent slopes	44	86.5	72.8%
132	Porser very stony fine sandy loam, 3 to 20 percent slopes	753	1.6	1.3%
165	Strych very stony fine sandy loam, 3 to 30 percent slopes	525	30.7	25.9%
Totals for Area of Interest			**118.8**	**100.0%**

Description

Total range production is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation. In a normal year, growing conditions are about average. Yields are adjusted to a common percent of air-dry moisture content.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Rating Options

Units of Measure: pounds per acre per year

Aggregation Method: Weighted Average

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Interpret Nulls as Zero: Yes

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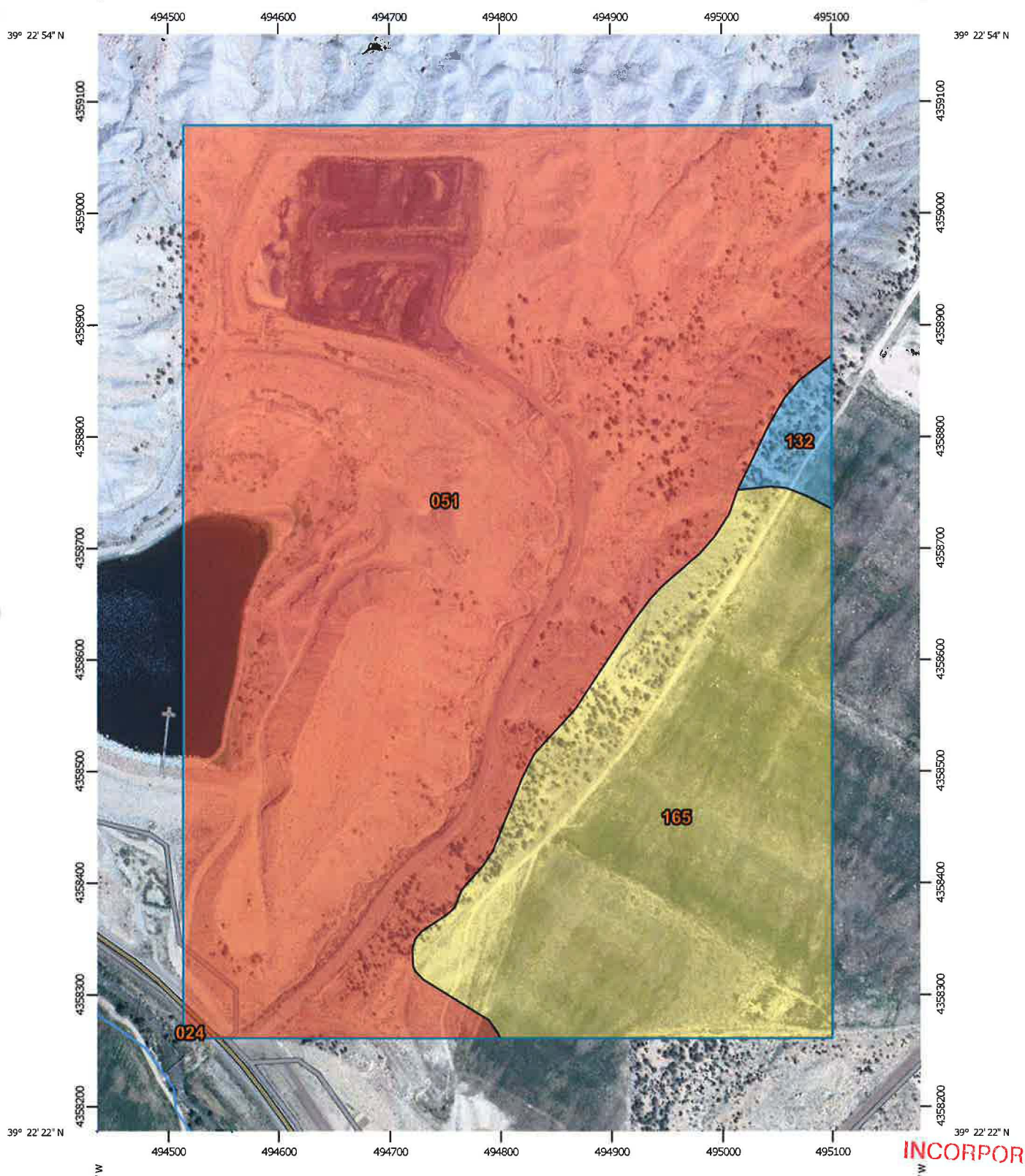
Range Production (Unfavorable Year)—Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
(Deer Creek Waste Rock Site)



Map Scale: 1:4,790 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

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MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- <= 19
- > 19 and <= 327
- > 327 and <= 403
- > 403 and <= 828
- Not rated or not available

Soil Rating Lines
- <= 19
- > 19 and <= 327
- > 327 and <= 403
- > 403 and <= 828
- Not rated or not available

Soil Rating Points
- <= 19
- > 19 and <= 327
- > 327 and <= 403
- > 403 and <= 828
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

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Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
Survey Area Data: Version 4, Aug 8, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2011—Sep 28, 2011

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Range Production (Unfavorable Year)

Range Production (Unfavorable Year)— Summary by Map Unit — Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties (UT623)				
Map unit symbol	**Map unit name**	**Rating (pounds per acre per year)**	**Acres in AOI**	**Percent of AOI**
024	Castledale-Colorow-Pherson complex, 1 to 5 percent slopes	828	0.0	0.0%
051	Gerst-Strych-Badland complex, 30 to 70 percent slopes	19	86.5	72.8%
132	Porser very stony fine sandy loam, 3 to 20 percent slopes	403	1.6	1.3%
165	Strych very stony fine sandy loam, 3 to 30 percent slopes	327	30.7	25.9%
Totals for Area of Interest			**118.8**	**100.0%**

Description

Total range production is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Rating Options

Units of Measure: pounds per acre per year

Aggregation Method: Weighted Average

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Interpret Nulls as Zero: Yes

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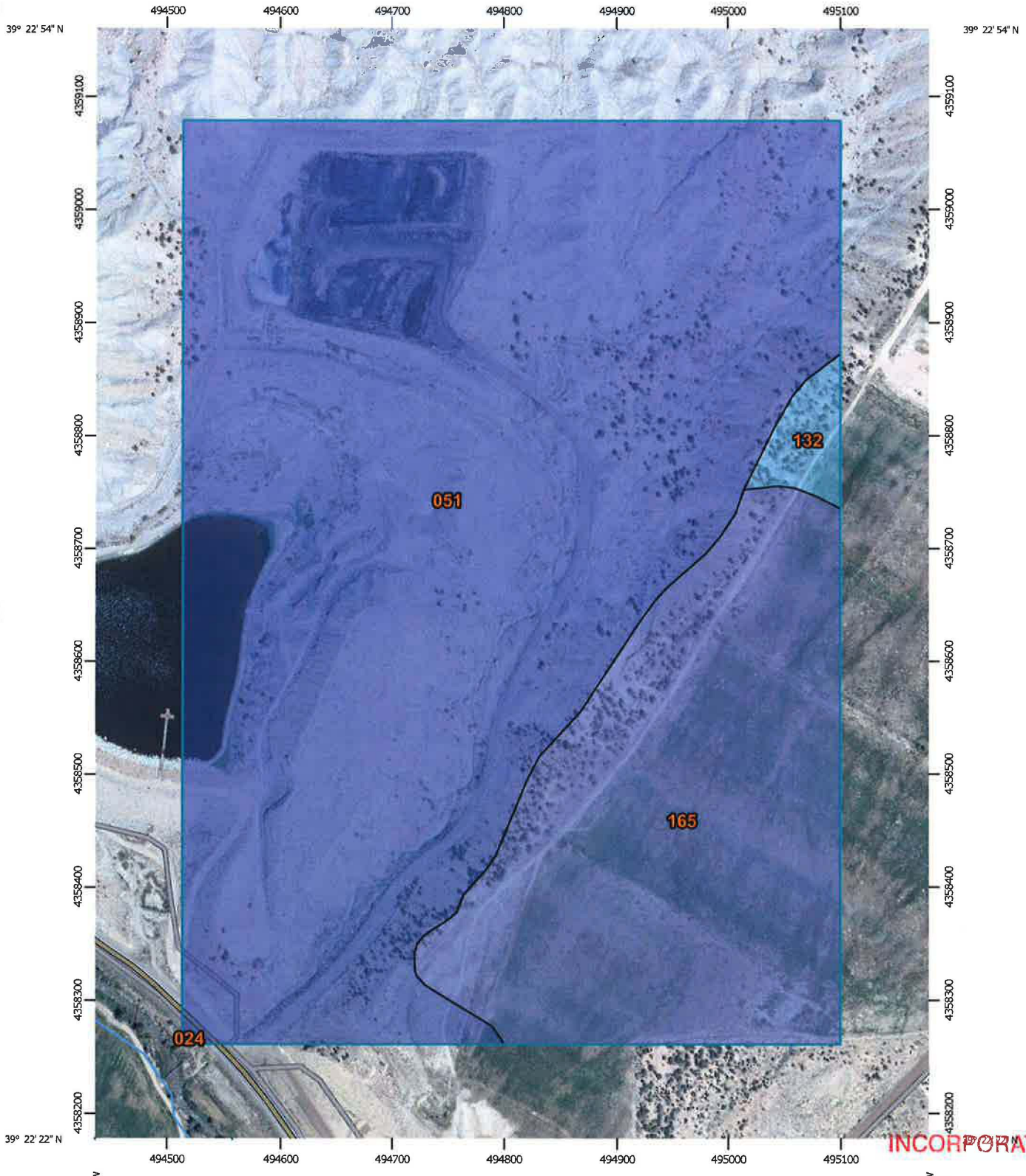
Nonirrigated Capability Class—Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
(Deer Creek Waste Rock Site)



Map Scale: 1:4,790 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

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MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Soil Rating Lines
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Soil Rating Points
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

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Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties
Survey Area Data: Version 4, Aug 8, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2011—Sep 28, 2011

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Nonirrigated Capability Class

Nonirrigated Capability Class— Summary by Map Unit — Emery Area, Utah, Parts of Emery, Carbon, Grand, and Sevier Counties (UT623)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
024	Castledale-Colorow-Pherson complex, 1 to 5 percent slopes	7	0.0	0.0%
051	Gerst-Strych-Badland complex, 30 to 70 percent slopes	8	86.5	72.8%
132	Porser very stony fine sandy loam, 3 to 20 percent slopes	6	1.6	1.3%
165	Strych very stony fine sandy loam, 3 to 30 percent slopes	7	30.7	25.9%
Totals for Area of Interest			**118.8**	**100.0%**

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Description

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels-capability class, subclass, and unit. Only class and subclass are included in this data set.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

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APPENDIX 2-2

Site-Specific Soil Data

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APPENDIX 2-2

Site-Specific Soil Data

Sample Name	pH	EC (mmho/cm)	%$CaCO_3$	P (ppm)	K (ppm)	Ca (meq/L)	Mg (meq/L)	Na meq/L)	SAR	% Sand	% Silt	% Clay	Texture Class	No_3N (ppm)
Sec 5, Site 1 Sample 1, 6"	7.47	1.31	26.75	0.8	72	11.7	4.4	3.3	1.2	23.1	40.0	36.9	CL	2.2
Sec 5, Site 1 Sample 2, 12"	7.53	2.18	25.50	0.8	64	22.0	3.5	3.3	0.9	29.1	36.0	34.9	CL	2.2
Sec 5, Site 1 Sample 3, 18"	7.60	2.57	21.15	0.8	61	20.2	4.3	9.6	2.7	25.1	40.0	34.9	CL	2.2
Sec 5, Site 1 Sample 4, 24"	7.56	3.0	22.60	0.8	70	22.1	12.7	7.7	1.8	49.1	30.0	20.9	L	2.2
Sec 5, Site 2 Sample 1, 6"	8.05	9.82	17.10	0.8	131	3.9	41.1	119.6	25.2	9.1	36.0	54.9	C	2.2
Sec 5, Site 2 Sample 2, 12"	7.99	11.43	16.54	0.8	130	3.5	39.2	143.5	31.0	9.1	38.0	52.9	C	2.2
Sec 5, Site 3 Sample 1, 6"	7.72	1.88	23.10	0.8	153	13.9	8.9	3.8	1.1	23.1	36.0	40.9	C	2.2
Sec 5, Site 3 Sample 2, 12"	7.85	0.57	24.81	0.8	92	4.0	2.4	1.9	1.1	33.1	32.0	34.9	CL	2.2
Sec 5, Site 3 Sample 3, 18"	7.68	2.73	20.26	0.8	106	16.5	25.7	2.9	0.6	23.1	38.0	38.9	CL	2.2
Sec 6, Site 4 Sample 1, 6"	7.63	2.07	19.49	0.8	63	22.7	4.1	1.9	0.5	29.	40.0	30.9	CL	2.2
Sec 6, Site 4 Sample 2, 12"	7.35	2.27	18.19	0.8	57	23.3	2.1	2.9	0.8	35.1	44.0	20.9	L	2.2
Sec 6, Site 4 Sample 3, 18"	7.50	2.18	21.02	0.8	48	20.7	3.4	2.4	0.7	37.1	34.0	28.9	CL	2.2
Sec 6, Site 5 Sample 1, 6"	7.74	2.50	47.19	0.8	111	20.4	6.4	3.9	1.0	33.1	42.0	24.9	L	2.2
Sec 6, Site 5 Sample 2, 12"	7.98	8.05	17.16	0.8	109	11.6	50.8	57.4	10.3	15.1	48.0	36.9	SiCL	2.2
Sec 6, Site 5 Sample 3, 18"	8.05	9.24	22.05	0.8	100	5.0	95.3	57.4	8.1	15.1	46.0	38.9	SiCL	2.2
Site 6 Sample 1, 6-9"	7.75	1.85	29.75	0.8	138	18.3	3.5	2.4	0.7	26.6	34.6	38.9	CL	2.2

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Sample Name	pH	EC (mmho/cm)	%$CaCO_3$	P (ppm)	K (ppm)	Ca (meq/L)	Mg (meq/L)	Na meq/L)	SAR	% Sand	% Silt	% Clay	Texture Class	No_3N (ppm)
Site 6 Sample 2, 14"	7.83	1.74	32.04	0.8	128	16.9	5.4	3.3	1.0	34.6	28.6	36.9	CL	2.2
Site 6 Sample 3, 18-20"	7.90	2.27	27.07	0.8	111	20.3	8.5	3.8	1.0	28.6	30.6	40.9	C	2.2
Site 7 Sample 1, 0-6"	7.90	1.88	31.84	0.8	115	18.6	5.3	2.4	0.7	34.6	26.6	38.9	CL	2.2
Site 7 Sample 2, 16"	7.97	3.02	4.03	0.8	92	18.9	7.4	12.4	3.4	30.6	36.6	32.9	CL	2.2
Site 8 Sample 1, 0-1'	8.3	12.7	8.4	3.0	28.9	22.5	19.2	140.0	30.7	6	43	51	SiC	1.0
Site 9 Sample 1, 0-0.3'	8.0	2.9	15.4	1.5	37.9	30.6	8.0	3.4	0.77	10	52	38	SiCL	6.0
Site 9 Sample 2, 0.3-1'	8.4	11.4	15.3	<0.1	24.6	21.1	19.2	125.0	27.8	10	53	37	SiCL	1.0
Site 9 Sample 3, 1.0-1.7'	8.5	16.4	14.3	0.5	35.2	21.6	39.0	197.0	35.8	10	54	36	SiCL	4.0
Site 9 Sample 4, 1.7-2.5'	8.2	16.2	11.6	2.5	50.8	22.0	45.7	187.0	32.1	8	51	41	SiC	46.5
Site 10 Sample 1, 0-0.5'	8.0	5.9	7.3	2.5	50	24.5	22.2	37.3	7.7	10	48	42	SiC	4.0
Site 10 Sample 2, 0.5-2.0'	8.0	17.1	7.8	1.8	37.2	21.4	71.4	189.0	27.8	15	50	35	SiCL	1.0
Site 10 Sample 3, 2.0-2.5'	8.2	17.8	8.7	1.2	45.4	21.4	71.7	199.0	29.2	16	51	33	SiCL	1.0
Site 11 Sample 1, 0-0.3'	8.1	4.3	12.0	1.2	27.8	27.2	7.3	26.6	6.4	24	46	30	CL	6.0
Site 11 Sample 2 0.3-1.7'	8.4	13.4	12.2	0.7	38.7	21.9	26.9	150.0	30.4	21	50	29	CL	2.0
Site 11 Sample 3, 1.7-2.4"	8.4	15.5	12.8	0.3	45	21.2	36.1	180.0	33.6	20	51	29	CL/SiCL	5.0
Site 11 Sample 4, 2.4-2.9"	8.4	14.6	13.3	1.0	39.5	21.0	37.7	157.0	29.0	22	50	28	CL	6.0

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Appendix 2-2 Notes:

1. See Plate 2-1 for sample locations.

2. All samples collected in April 1987, prior to site disturbance.

3. All samples analyzed by:

NPI Soil Testing/Plant Tissue Analysis Lab
417 Wakara Way
Salt Lake City, UT 84108

4. Texture class designations:

CL	=	Clay Loam
L	=	Loam
C	=	Clay
SiCL	=	Silty Clay Loam

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CHAPTER 3
BIOLOGY

3.10 Introduction

This chapter provides a general description of the biological resources found in the vicinity of the Deer Creek waste rock site (the "Deer Creek site" or the "site"), and describes measures that will be taken to protect biological resources within and adjacent to the permit area.

3.1.1 Vegetative, Fish and Wildlife Resources

Vegetative, fish, and wildlife resources in the vicinity of the Deer Creek site are discussed in Section 3.20. Additional information regarding vegetative resources is provided in Appendices 3-1 and 3-2.

3.1.2 Potential Impacts to Vegetative, Fish and Wildlife Resources

Potential impacts to vegetative, fish and wildlife resources and the associated mitigation plans are presented in Sections 3.30 and 3.40 of this application.

3.1.3 Description of Reclamation Plan

The plan to reclaim vegetative, fish and wildlife resources to a condition suitable for the post-operations land use is presented in Section 3.40.

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3.20 Environmental Description

3.2.1 Vegetation Information

3.2.1.1 Plant Communities Within the Proposed Permit and Adjacent Areas

A vegetation survey of the permit area was performed by Mt. Nebo Scientific in 1987 prior to site disturbance. The results of this survey are provided in Appendix 3-1. As indicated, vegetation in the permit area is characterized primarily as a Gardner Saltbush/Mat Saltbush plant community, with Pinyon/Juniper communities within the larger community. Dominant species in these smaller plant communities consist of pinyon and juniper trees, black sagebrush, and shadscale. The general pre-disturbance distribution of vegetation in the permit area is shown on Plate 3-1.

From data presented in Appendix 3-1, the vegetative species within the Gardner Saltbush/ Mat Saltbush community in the permit area consist of the following:

Shrubs:

- Black sagebrush (*Artemisia nova*)
- Castle Valley saltbrush (*Atriplex gardneri var. cuneate*)
- Shadscale (*Atriplex confertifolia*)
- Mat saltbush (*Atriplex corrugata*)
- Rubber rabbitbrush (*Chrysothamnus nauseosus*)
- Low rabbitbrush (*Chrysothamnus viscidiflorus*)
- Mormon tea (*Ephedra viridis*)
- Corymb buckwheat (*Eriogonum corymbosum*)
- Utah juniper (*Juniperus osteosperma*)
- Greasewood (*Sarcobatus vermiculatus*)
- Cottonthorn horsebrush (*Tetradymia spinosa*)

Forbs

- Cryptantha (*Cryptantha flava*)
- Spring parsley (*Cymopterus purpureus*)

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- Gordon's buckwheat (*Eriogonum gordonii*)
- James wild buckwheat (*Eriogonum jamesii*)
- Buckwheat (*Eriogonum sp.*)
- Goldenweed (*Haplopappus ep.*)
- Parthenium (*Parthenium sp.*)
- Phacelia (*Phacelia crenulata*)
- Phacelia (*Phacela sp.*)

Grasses:

- Salina wildrye (*Elymus salinus*)
- Indian ricegrass (*Orizopsis hymenoides*)
- Squirreltail (*Sitanion hystrix*)

3.2.1.2 Land Productivity Prior to Mining

A reference area with representative slope, soil, exposure, species composition, and other environmental factors was chosen in 1987 as a standard for future reclamation of the site. The mean percent cover in the reference area was calculated as follows at the time of the 1987 survey:

- Living cover = 38.93%
- Litter = 8.40%
- Rock = 7.50%
- Bare ground = 45.33%

Information presented in Section 2.2.2.4 of this application indicates that, under favorable conditions, the soils in the permit area can produce only 63 pounds of rangeland vegetation per acre annually. These production values drop to 44 lb/acre/yr under normal and 19 lb/acre/yr under unfavorable conditions (see Appendix 2-1).

Appendix 3-2 presents the results of an evaluation conducted by Mt. Nebo Scientific wherein the mean percent cover of the reference area (as measured in 1987) was compared with the mean percent cover of the reclaimed fill along the site access road (as measured in 1995). As

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indicated, the mean percent live vegetative cover for the reference area and the access road fill were 38.93% and 38.33%, respectively. Total ground cover (which includes live vegetation, litter, and rock) was 54.67% on the reference area and 74.17% on the fill slopes. This, it is reasonable to assume that land productivity following reclamation will be similar to pre-disturbance conditions in the permit area.

3.2.2 Fish and Wildlife Information

Undisturbed lands in the area generally support wildlife habitat. The generally poor soil and sparse vegetation of the area limit the degree to which wildlife frequent the area. Given the lack of perennial and intermittent surface water, there is no fish habitat within the permit area.

3.2.2.1 Level of Detail

The scope and level of detail for identification of fish and wildlife resources are considered sufficient to design a protection and enhancement plan consistent with the requirements of R645-301-333.

3.2.2.2 Site-specific Resource Information

A site-specific evaluation of wildlife within the permit and adjacent areas was conducted of the permit area in 1988 prior to disturbance of the site. The results of this survey, which was conducted by Val Payne of Utah Power and Light Company in consultation with Larry Dalton of the Utah Division of Wildlife Resources, are provided on Plate 3-2. As indicated, portions of the permit area serve as critical winter habitat for mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*). Specific wildlife use areas associated with the site include migration routes, open areas, and bedding areas as indicated on Plate 3-2.

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A review of information maintained by the Utah Conservation Data Center[1] indicates that no threatened or endangered species, nor habitat for such species, are present within the permit area. However, this site indicates that the following species of concern may be present within the USGS quadrangle in which the Deer Creek site is located (i.e., the Hiawatha 7.5 minute quadrangle):

- Ferruginous Hawk (*Buteo regalis*): According to the Utah Conservation Data Center, this species of concern was last observed in the Hiawatha quadrangle on December 13, 2008. It is identified as a Utah species of concern, with a global status rank of G4 (indicating that it is a species that is widespread, abundant, and apparently secure, though it may be quite rare in parts of its range, especially at the periphery) and a State status rank of S3B (indicating that it is a species that is either very rare and local throughout its range or found locally [even abundantly at some of its locations[within a restricted range, or vulnerable to extinction or extirpation because of other factors, particularly during breeding season).
- Colorado River Cutthroat Trout (*Oncorhynchus calrkii pleuriticus*): According to the Utah Conservation Data Center, this species was last observed in the Hiawatha quadrangle on October 19, 2005. This species is receiving special management under a Conservation Agreement in order to preclude the need for Federal listing. It has a global status rank of G4T3 (indicating that some infraspecific taxa of the species may warrant a global numeric ranking of 3 rather than 4) and a State status rank of S3.
- Western Toad (*Bufo boreas*): According to the Utah Conservation Data Center, this species of concern was last observed in the Hiawatha quadrangle on July 25, 1964. It is identified as a Utah species of concern, with a global status rank of G4 and a State status rank of S3.

Although the Ferruginous Hawk may be present in the general area of the Deer Creek site, its preferred nesting sites (cliffs, buttes, and creek banks) do exist within the area where coal recovery operations will be conducted. Furthermore, dust will be suppressed during operations, thereby minimizing the potential for impacts from this source. Therefore, no significant impacts are anticipated to Ferruginous Hawks in the area from the planned site activities.

No perennial streams occur within the permit area. Furthermore, site activities will be conducted in a manner that minimizes contributions of sediment and other pollutants to the closest perennial source of water (Huntington Creek). Therefore, coal recovery operations at the site should not adversely impact Colorado River Cutthroat Trout in the region.

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[1] http://dwrcdc.nr.utah.gov/ucdc/, accessed 21 Jan 2015.

The Western Toad habitat consists primarily of slow-moving streams, wetlands, and other perennial sources of water. Since these sources are absent within the permit area and protected from contributions of sediment and other pollutants outside of the permit area, coal recovery operations at the site should not adversely impact Western Toads in the region.

Additional information regarding the potential for important biological resources to be present in the permit area was obtained from the "IPaC Information for Planning and Construction" web site maintained by the U.S. Fish and Wildlife Service. The IPaC Trust Resource Report and associated Section 7 letter obtained from this web site are provided in Appendix 3-4. The Resource Report and the Section 7 letter indicate that the following threatened or endangered species may occur in the region of the permit area:

- Birds:
  - Mexican Spotted Owl (*Strix occidentalis lucida*)
  - Southwestern Willow Flycatcher (*Empidonax traillii extimus*)
  - Yellow-billed Cuckoo (*Coccyzus americanus*)
- Fishes:
  - Bonytail Chub (*Gila elegans*)
  - Colorado Pikeminnow (*Ptychocheilus lucius*)
  - Humpback Chub (*Gila cypha*)
  - Razorback Sucker (*Xyrauchen texanus*)
- Flowering Plants:
  - Barneby Reed-mustard (*Schoenocrambe barnebui*)
  - Jones Cycladenia (*Clycladenia humilis var. jonesii*)

The report and letter further state that no critical habitats occur within the permit area for these threatened or endangered species. None of these species are known to exist in the permit area.

According to information provided in the Deer Creek Mine mining and reclamation plan, the nearest known raptor nests are approximately 1.3 miles northeast of the site. Golden eagles have been observed in flight above the general area where the site is located. Furthermore, as

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indicated above, the absence of perennial and intermittent water indicates that no fish habitat exists within the permit area.

Under the U.S. Fish and Wildlife Service Windy Gap Process, projects within the Upper Colorado River Basin may be assessed a one-time conservation fee, depending on annual water usage, to study and protect endangered fish species. The conservation fee is generally assessed only if the annual water consumption exceeds 100 acre-feet. The applicant acknowledges that the assessment of the conservation fee must be decided by the U.S. Fish and Wildlife Service, with this assessment potentially being independent of the 100 acre-foot value.

Calculations provided in Appendix 3-5 estimate that less than 2 acre-feet of water will be used for dust-suppression and moisture conditioning purposes during the course of this project. This water may be obtained from the sedimentation pond (if available and practical) but more likely will be obtained from nearby municipal or industrial sources. As indicated in Section 7.2.4.2 of Chapter 7, the average annual flow of Huntington Creek near the permit area is 109.0 cubic feet per second (78,900 acre-feet per year). Assuming that all of the project water is obtained from Huntington Creek and/or from the sedimentation pond (i.e., water that theoretically could have reached Huntington Creek), the total estimated project water usage (1.92 acre-feet) represents just 0.002% of this annual flow.

Stream gaging records are developed by correlating the depth (or "stage") of streamflow with the measured streamflow at a gaging station. Rantz et al. (1982) indicate that current-meter methods (the standard approach used to measure streamflow) are accurate to within approximately 2.2 percent if properly used. Additional error is introduced in the stage measurements. Thus, the potential decrease in streamflow in Huntington Creek due to project water usage is at least 1000 times less than the accuracy of the methods used to measure streamflow, indicating that the amount of project water usage is insignificant compared to the flow of Huntington Creek. This impact will be even less if the project water is obtained from a supplier that uses groundwater as its source.

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Given the minimal amount of water to be used on the project, it is concluded that impacts to fish habitat will also be insignificant and not practically measurable.

As indicated above, project water will likely be obtained (purchased) from nearby municipal or industrial water sources. Rights for the use of this water will be the responsibility of the seller. In the case of water obtained from the sedimentation pond, water rights are normally not filed for ephemeral sources due to their unreliability. If used, this water will be applied at or adjacent to the ground from which it flowed.

3.2.2.3 Fish and Wildlife Service Review

If requested, the applicant authorizes the release of information pertaining to Section 3.2.2 and 3.3.3 to the U.S. Fish and Wildlife Service Regional and Field office for their review.

3.2.3 Maps and Aerial Photographs

The results of vegetation and wildlife surveys in the permit area are provided on Plates 3-1 and 3-2, respectively. The location of the reference area for determining revegetation success is shown on Plate 3-1. This map also shows the general pre-disturbance boundaries of plant communities and vegetation sample areas. No monitoring stations have been established to gather ongoing data for fish and wildlife or any special habitat features.

3.30 Operation Plan

3.3.1 Measures Taken to Disturb the Smallest Practicable Area

No disturbance will occur beyond the permit area boundary. New disturbances (if they occur) will be kept to the smallest practicable area. All currently-disturbed areas may be used for active operations. Thus, interim revegetation of the site is not feasible.

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3.3.2 Description of Anticipated Impacts of Subsidence

No underground mining operation will occur within the permit area. Thus, the planned actions will not result in subsidence of renewable resource lands.

3.3.3 Plan to Minimize Disturbances and Adverse Impacts

The fence surrounding the permit area was designed to be compatible with wildlife migration. This fence will be maintained during operations. No disturbance will occur outside of that fenced area. Furthermore, runoff control measures will be maintained to preclude off-site surface-water impacts. Other protective measures within the disturbed area boundary will include adhering to clean industrial hygiene procedures, properly disposing of all waste (papers, cans, bottles, etc.), and instructing employees not to hunt or harass wildlife in the permit and adjacent areas. Thus, measures will be implemented to minimize adverse impacts to fish and wildlife and related environmental resources.

3.40 Reclamation Plan

Information regarding final revegetation of disturbed ground within the permit area is provided below. The extent of site restoration following operations is discussed more fully in Section 5.40 of this permit application.

3.4.1 Revegetation

Disturbed areas will be revegetated, following completion of site activities, in a manner that complies with the biological protection standards of the State of Utah Coal Mining Rules as promulgated in R645.

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3.4.1.1 Schedule and Timetable

Revegetation of disturbed areas will begin after the topsoil has been redistributed. To the extent feasible, seeding will occur in the late fall, just prior to the onset of snow fall. If this schedule is not feasible, grasses and forbs will be planted in the late spring (May or early June), while shrubs will be planted in the late summer through early fall (late August through early October). A detailed schedule for implementation of the revegetation plan is discussed in Section 5.4.2.1 of this permit application.

3.4.1.2 Descriptions

Species and Amounts of Seed. All revegetated areas will be planted with the seed mix specified in Table 3-1. This seed mix was developed in consultation between Lisa Reinhart of the Utah Division of Oil, Gas and Mining and Makeda Trujillo Hanson of the Utah Division of Wildlife Resources (see Appendix 3-3). At the recommendation of Ms. Reinhart, the non-native forb substitutes recommended by Ms. Hanson were not included in Table 3-1.

Method Used for Planting and Seeding. Revegetation will be performed using broadcast, hydroseed, or drill seed methods. If drill seeding is used, the application rates of the grasses and forbs in Table 3-1 will be reduced by 50 percent.

Mulching Techniques. Mulch will be applied to seeded areas in accordance with Section 2.4.4.2 of this application.

Irrigation, Pest, and Disease Control. No persistent pesticides will be used in the permit area unless previously approved by DOGM.

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Measures Proposed for Revegetation Success. Revegetation success will be monitored in accordance with the requirements of R645-301-356. These measures are discussed in Section 3.5.6 of this permit application.

3.4.1.3 Greenhouse Studies, Field Trials or Other Equivalent Studies

If DOGM requires additional testing for the purpose of demonstrating that reclamation as required by the State Program can be accomplished according to information given in this document, the applicant will comply.

3.4.2 Fish and Wildlife

3.4.2.1 Enhancement Measures

Wildlife habitat will be enhanced during reclamation through the use of runoff controls to prevent excessive erosion and through the use of a seed mix that includes plants that are indigenous to the area and that serve as valuable wildlife forage.

3.4.2.2 Plants Used for Wildlife Habitat

The reclamation plan has been specifically developed to support post-operation land use by wildlife. In particular, the plant species presented in Table 3-1 include those that will provide adequate nutritional value for big game as well as cover for small game (see Appendix 3-3). Plant species that are native to the area (and thereby appropriately adapted to local soils, climate, etc.) were selected to ensure long-term survival following the release of performance bonds.

3.4.2.3 Cropland

Cropland is not a post-operation land use.

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3.4.2.4 Residential, Public Service and Industrial Land Use

Neither residential, public service, nor industrial post-operation land uses are anticipated for the permit area.

3.50 Performance Standards

3.5.1 General Requirements

The Applicant commits to conduct all operations in accordance with Sections R645-301-330 through R645-301-340 of the regulations.

3.5.2 Contemporaneous Reclamation

Given the relatively short duration of anticipated coal recovery operations at the Deer Creek site, contemporaneous reclamation is not considered practical.

3.5.3 Revegetation: General Requirements

The revegetation plan presented herein complies with the requirement that a vegetative cover be established on all reclaimed areas. The vegetative cover will be established in accordance with the approved permit and reclamation plan.

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3.5.3.1 Vegetative Cover

The seed mix presented in Table 3-1 is intended to provide vegetative cover that will be diverse, effective, and permanent. The seed mix is comprised of species native to the area recommended by the Utah Division of Wildlife Resources for enhancement of wildlife habitat.

The seed mix was selected with to be compatible with the climate, potential seedbed quality, and drought tolerance.

Native Species. The vegetative mixture is primarily comprised of species native to the area. The seeds will be purchased from suppliers who will certify their purity, germination, hard seed, and percentages of maximum weed seed contents.

Extent of Cover. The seed mix presented in Table 3-1 has been designed to result in vegetative cover that will be at least equal in extent to the natural vegetation as measured in an adjacent reference area at the time of revegetation.

Stabilizing. The area to be revegetated will be mulched during reclamation. This mulching, together with the vegetative cover mixture and surface roughening of the redistributed topsoil, will provide erosional stability at least equivalent to that of adjacent undisturbed areas.

3.5.3.2 Reestablished Plant Species

Compatible. The plant species proposed for revegetation have been selected to be compatible with the intended post-operation land use of wildlife habitat.

Seasonal Characteristics. Because the reclamation seed mix is dominated by native species, the revegetation plant species will have the same growing season as the native vegetation.

Self-generation. The revegetation seed mix consists of species capable of self-generation and plant succession.

Compatibility. The seed mix proposed for revegetation contains plants native to the area and compatible with the plant and animal species of the permit area.

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Federal and Utah Laws or Regulations. The seed mixture purchased to revegetate the mine area will contain neither poisonous nor noxious plant species. The mix will also be compatible with introduced species laws and regulations.

3.5.3.3 Vegetative Exception

The applicant does not require vegetative exception at this time.

3.5.3.4 Cropland

The permit area contains no land designated as cropland for post-operation land use.

3.5.4 Revegetation: Timing

Reclaimed areas will be revegetated during the first favorable period for planting, as discussed in Section 3.4.1.1.

3.5.5 Revegetation: Mulching and Other Soil Stabilizing Practices

Areas to be revegetated will be mulched as described in Section 3.4.1.2. The redistributed topsoil will also be left in a roughened state prior to revegetation, as described in Section 5.4.2 of this application. If excessive erosion occurs following revegetation and prior to bond release, those affected areas will be repaired using a method approved by DOGM.

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3.5.6 Revegetation: Standards for Success

3.5.6.1 Success of Revegetation

The success of revegetation will be judged on the effectiveness of the vegetation for post-operation land use and the standards outlined in Section 3.5.3. Success of the revegetation effort in the permit area will be determined by use of and in comparison to data obtained from the reference area shown on Plate 3-1.

Final comparisons will involve random sampling of both the reference area and the revegetated site. All sampling will be done in the late summer to insure maximum plant growth. Estimates of ground cover and density of woody plant species will be made for the revegetated areas and the reference areas using the following methods:

- Quantitative and qualitative data will be collected on the reclaimed areas. Information to be recorded during field surveys will include not only vegetation data but also observations concerning recent precipitation, slope, exposure, wildlife use, and other appropriate notes
- Bi-directional random placement of sampling plots will be used to provide unbiased accuracy of the data compiled.
- Cover estimates will be made using ocular methods with meter square quadrats.
- Density of woody plant species will be estimated using the point quarter distance method (Cottam and Curtis, 1956). In this method, random points will be placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species will then be recorded in each quarter. The average point-to-individual distance will be calculated as the square root of the mean area per individual.
- Sampling adequacy for cover and woody species density will be sufficient to insure that the required statistical confidence is achieved. This will be evaluated using formulas from Snedocor and Cochran (1980), ensuring that 80% of the samples are within 10% of the true mean for the shrub communities of the area. Student's t-tests will be employed to compare the proposed disturbance and reference areas of all sites for cover and woody plant species density.
- Jaccard's Community Coefficients will be used to make species composition comparisons.

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3.5.6.2 Standards for Success

Standards of success will be applied in accordance with the approved post-operation wildlife habitat land use. Revegetation efforts will be considered successful if the total ground cover in the reclaimed areas is at least 90% of the total ground cover in the reference area, with 90% statistical confidence at the time of the comparison. The species diversity of the revegetated areas will be considered successful if there is a 50% or greater similarity in the life forms present between the reference area and the reclaimed plant community.

3.5.6.3 Siltation Structure Maintenance

Siltation structures will be maintained until removal is authorized by the Division and the disturbed areas have been stabilized and revegetated. For additional details on siltation structures, see Section 5.4.2.

3.5.6.4 Removal of Siltation Structures

Upon removal of siltation structures at the site, the land on which the siltation structure was located will be revegetated in accordance with this plan.

3.5.7 Revegetation: Extended Responsibility Period

BRC Wellington ("BRCW") will be responsible for revegetation success during the extended responsibility period. The period of extended responsibility will begin after the last year of augmented seeding, fertilization, irrigation, or other revegetation work, excluding husbandry as approved by the Division. Vegetation parameters will equal or exceed the approved success standard during the last two years of the responsibility period. The success standards are outlined in Sections 3.5.6.1 and 3.5.6.2 of this application.

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If required to enhance revegetation efforts, BRCW may implement husbandry practices on reclaimed area, but only if approved beforehand by the Division. These husbandry practices, if needed, would consist of normal conservation practices within the region of the operation. These practices may include disease, pest, and vermin control; pruning; reseeding; and transplanting. BRCW acknowledges that any such work must be conducted in accordance with R645-301-357.300 and may affect the timing of bond release as stipulated in that rule.

3.5.8 Protection of Fish, Wildlife, and Related Environmental Values

This plan is designed to minimize disturbances and adverse impacts on fish, wildlife and their related environments. BRCW will periodically educate their employees about wildlife needs and their importance. The mitigation requirements of Section 3.3.3 of this application will also be discussed with existing employees during periodic staff meetings and with new employees during initial orientation. Given the lack of permanent surface water in the permit and adjacent areas, there are no fisheries within the permit area.

3.5.8.1 Existence of Endangered or Threatened Species

There are no known endangered or threatened species within the permit area. Therefore, facility operations will not result in the destruction or adverse modification of critical habitats. If State- or Federally-listed endangered or threatened species are discovered in the permit area in the future, the presence of these species will be reported to the Division upon their discovery. Operations thereafter, including site reclamation, will proceed in accordance with appropriate Division stipulations to protect those species.

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3.5.8.2 Bald and Golden Eagles

No suitable bald or golden eagle habitat exists in the permit and adjacent areas. The nearest known raptor nests are approximately 1.3 miles northeast of the site. Golden eagles are occasionally observed in flight above the general area but none are known to inhabit the permit or adjacent areas.

If bald or golden eagle habitat is discovered in the permit or adjacent area in the future, BRCW will promptly report such habitat to the Division and will proceed with operations thereafter in accordance with appropriate Division stipulations to avoid impacts to that habitat. BRCW will also make employees aware of the species and their prey base during periodic staff meetings in accordance with Section 3.5.8 of this plan.

3.5.8.3 Taking of Endangered or Threatened Species

The applicant understands that there is no permission implied by these regulations for taking of endangered or threatened species, their nests, or eggs.

3.5.8.4 Replacement of Wetland and Riparian Vegetation

No wetland or riparian habitat exists in the permit area, nor has any such habitat been disturbed by this operation. The closest riparian habitat is located along Huntington Creek approximately 0.4 mile southwest of the waste rock pile and about 200 feet southwest of the southwest edge of the permit area. All operations associated with this application will be conducted in a manner that avoids disturbances to wetlands and riparian vegetation along Huntington Creek.

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3.5.8.5 Manmade Wildlife Protection Measures

Electric Power Lines. No electric power lines exist within the permit area.

Potential Barriers. Fences that surround the permit area have been design to allow crossing by big game.

Pond Protection. No site ponds contain hazardous concentrations of toxic-forming materials.

REFERENCES CITED

Cottam, G. and J.T. Curtis. 1956. The Use of Distance Measures in Phytosociological Sampling. Ecology. Volume 37, No. 3, pp. 451-460.

Rantz, S.E. et al. 1982. Measurement and Computation of Streamflow: Volume 1. Measurement of State and Discharge. U.S. Geological Survey Water-Supply Paper 2175. Washington, D.C.

Snedecor, G. W. and W.G. Cochran, W. G. 1980. Statistical Methods. Iowa State University Press. Ames, Iowa.

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TABLE 3-1

Revegetation Seed Mixture

Scientific Name	Common Name	Application Rate (pls lb/acre)
Shrubs		
Artemisia tridentata	Wyoming big sagebrush	1.0
Atriplex canescens	Fourwing saltbush	1.0
Ceratoides lanata	Winterfat	0.5
Forbs		
Acillea millefolium	Western yarrow	0.01
Cleame serrulata Pursh	Rocky Mountain Beeplant	1.0
Helianthus annus	Annual sunflower	1.0
Linum lewisii	Lewis flax	1.0
Penstemon palmeri	Palmer's penstemon	0.5
Sphaeraicea coccinea	Scarlet globemallow	0.5
Grasses		
Agropyron dasystachyum	Thickspike wheatgrass	1.0
Hilaria jamesii	Galleta	0.5
Leymus salinus	Salina wildrye	0.5
Oryzopsis hymenoides	Indian ricegrass	1.0
Poa sandbergii	Sandberg bluegrass	1.0
TOTAL (pls lb/ac)		**10.01**

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APPENDIX 3-1

Vegetation Survey of the Permit Area

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VEGETATION OF THE PROPOSED

DEER CREEK MINE

WASTE ROCK STORAGE FACILITY

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SCOPE

The following is a report of the vegetation of the proposed Deer Creek Waste Rock Storage Facility for the Deer Creek Mine, Emery County, Utah. The primary purpose of this report is to supply meaningful and scientific data that will provide accurate standards for future reclamation of this area. Proposed disturbance areas and reference areas similar to the proposed disturbance areas, were studied on the site. Studies were performed in accordance to the guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM).

A METHODS section is included in this report to provide the reviewers with all methodologies used to obtain the data. Within the INTRODUCTION of the report, a General Site Description section is provided to give an overview of the entire site. The RESULTS section specifically describes each proposed disturbed plant community, reference areas and also supplies results of data analyses and statistical testing from ecological sampling. A VEGETATION MAP of each area is also included in this report. (See map # CM-10777 DR, Map Packet 8-1)

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INTRODUCTION

General Site Description

The study site for the Deer Creek Waste Rock Storage Facility for the Deer Creek Mine is located in Huntington Canyon, West of Huntington, Utah. The area is located on the north side of Huntington Canyon, northeast of the power plant, and north of the Utah Power & Light agricultural farms. Elevation ranges around 6,300 ft above sea level.

The major vegetation type proposed to be disturbed on this site is a Gardner Saltbush/Mat Saltbush community. It is comprised, however, of several, relatively small, isolated plant communities. The area has many small slopes ranging from 2 to 21 degrees. The aspects are nearly as variable with exposures to the east, west and south. The variations in slope and aspect provide variable habitats for plant species. For example, there is a small area on the border of the disturbed area that supports a small stand of pinyon and juniper trees. There are also fingers on the ridges and on the more gently sloped areas that support nearly monocultures of mat saltbush (Atriplex corrugata). Moreover, the steeper slopes, often with east exposures, are dominated by Gardner saltbush. Furthermore, some of the more gentle slopes and part way up the west facing steeper slopes, stands of black sagebrush (Artemisia nova) and shadscale (Atriplex confertifolia) are the dominant plant species.

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METHODS

Quantitative and qualitative data were taken on and adjacent to the proposed disturbed areas. Bi-directional random placement of sampling plots were designed to provide unbiased accuracy of the data compiled. Cover estimates were made using ocular methods with meter square quadrats. Also recorded on data sheets were estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes.

Density of woody plant species were recorded using the point quarter distance method (Cottom and Curtis 1956). In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual.

The areas were surveyed on a grid system for threatened and endangered plant species. Voucher specimens for many on the species will be filed at the Brigham Young University herbarium. Plant nomenclature follows Welch et al. (1987).

Sampling adequacy for cover and woody species density was achieved using formulas from Snedocor and Cochran (1980), insuring that 80% of the samples were within 10% of the true mean for the shrub communities of the area. Student's t-tests were also employed to compare the proposed disturbance and reference areas of all sites for cover and woody plant species density. Jaccard's Community Coefficient's were used to make species composition comparisons. All sample means, standard deviations, and sample sizes were included in this report to enable the reviewers to apply further statistical tests if desired.

Productivity was estimated and range condition was evaluated by Soil Conservation Service personnel. (See attached letter from George S. Cook - following Table #8, page 8-17)

Vegetation mapping was done by walking the area and using aerial photos and contour maps. Sampling locations are also shown on these maps. (See maps number CM-10777 DR, located in map packet # 8-1)

RESULTS

Proposed Disturbed Gardner Saltbush/Mat Saltbush Community

Because of the variability and diversity of habitats in this area, and because these areas were often relatively small and isolated, long transects were randomly placed on the area to insure that vegetation sampling would include a representation of the community type as a whole.

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The community is identified as a Gardner Saltbush/Mat Saltbush Community. Woody plant species and grasses dominate this community comprising 78.89% and 19.70% of the living cover, respectively (Table 1). Total cover was estimated at 39.05%. Dominant shrub species of the community were Gardner Saltbush (Atriplex gardneri) and mat saltbush (Atriplex corrugata). Dominant grass species are salina wildrye (Elymus salinus) and Indian ricegrass (Oryzopsis hymenoides). For a listing of cover by species, refer to Table 2. Density of woody plants was estimated at 5,894.45 individuals per acre (Table 3).

Reference Area for the Gardner Saltbush/Mat Saltbush Community.

A reference area with similar slope, soils, exposure, species composition, precipitation, elevation and other environmental variables was chosen as a standard for future reclamation of the site. For total cover and species composition of this reference area, refer to Table 4. For cover estimated by species, refer to Table 5. For total woody species density and density by species, refer to Table 6. A combined species list for the two areas is shown on Table 7.

Statistical analyses indicated that the proposed disturbed and reference areas to be 74.07% similar by species. The two communities were not significantly different by cover or densities when compared by t-tests. For a summary on the statistics employed, refer to Table 8.

Threatened and Endangered Plant Species

No threatened or endangered plant species were found during the course of the study. As mentioned previously, voucher specimens will be donated to the herbarium at Brigham Young University.

Supplemental Vegetation Sampling

Supplemental vegetation sampling will be conducted in the Pinyon-Juniper community during the 1988 growing season, prior to disturbance. Data similar to that found in this report will be generated for the proposed disturbed and reference areas in this community. This information will be forwarded to the Division for inclusion in the existing permit.

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TABLE 1 The proposed disturbed area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover and composition with standard deviations and sample sizes.

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZES
Total Living Cover*	39.05	12.34	20
Litter	4.35	4.18	20
Rock	8.45	12.25	20
Bareground	48.65	15.12	20
COMPOSITION			
Shrubs	78.89	32.60	20
Forbs	1.41	4.10	20
Grasses	19.70	30.01	20

* Sample size insures 80% accuracy within 10% of the true mean.

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TABLE 2 The proposed disturbed area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover, standard deviation, sample size and relative frequency by species.

SPECIES	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE	RELATIVE FREQUENCY
SHRUBS				
Artemisia nova	3.40	8.86	20	20.00
Atriplex gardneri	17.00	16.46	20	75.00
Atriplex confertifolia	3.25	11.50	20	10.00
Atriplex corrugata	4.35	11.29	20	20.00
Chrysothamnus viscidiflorus	1.10	1.92	20	30.00
Sarcobatus vermiculatus	.75	2.45	20	10.00
FORBS				
Cryptantha flava	.25	.91	20	10.00
Cymopterus purpureus	.05	.22	20	5.00
Eriogonum gordonii	.25	1.12	20	10.00
GRASSES				
Elymus salinus	4.60	10.96	20	20.00
Oryzopsis hymenoides	3.10	7.79	20	30.00
Sitanion hystrix	.60	1.57	20	15.00

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TABLE 3 Woody species densities of the proposed disturbed area of the Gardner Saltbush/Mat Saltbush Community.

	NUMBER/ACRE*
Artemisia nova	343.89
Atriplex gardneri	2,406.90
Atriplex confertifolia	785.93
Atriplex corrugata	1,277.13
Chrysothamnus nauseosus	49.12
Chrysothamnus viscidiflorus	687.69
Sarcobatus vermiculatus	49.12
Suaeda torreyana	245.60
Tetradymia spinosa	49.12
TOTAL	5,894.45

* Sample size was 30 (n=30) and insured that 80% accuracy within 10% of the true mean.

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TABLE 4 The reference area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover and composition with standard deviations and sample sizes.

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZES
Total Living Cover*	38.93	14.79	30
Litter	8.40	5.01	30
Rock	7.50	6.63	30
Bareground	45.33	17.21	30
COMPOSITION			
Shrubs	84.09	24.91	30
Forbs	1.13	3.05	30
Grasses	14.78	24.70	30

* Sample size insures 80% accuracy within 10% of the true mean.

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TABLE 5 The reference area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover, standard deviation, sample size and relative frequency by species.

SPECIES	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE	RELATIVE FREQUENCY
SHRUBS				
Artemisia nova	6.50	11.23	30	30.00
Atriplex gardneri	11.37	17.17	30	46.67
Atriplex confertifolia	4.23	7.85	30	36.67
Atriplex corrugata	.57	3.10	30	3.33
Chrysothamnus nauseosus	.17	.91	30	3.33
Chrysothamnus viscidiflorus	6.10	6.82	30	53.33
Ephedra viridis	.50	2.74	30	6.67
Eriogonum corymbosum	2.33	5.86	30	26.67
FORBS				
Cryptantha flava	.07	.25	30	10.00
Cymopterus purpureus	.17	.91	30	6.67
Phacelia crenulata	.07	.25	30	6.67
GRASSES				
Elymus salinus	3.50	8.11	30	16.67
Oryzopsis hymenoides	2.70	5.53	30	30.00

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TABLE 6 Woody species densities of the reference area of the Gardner Saltbush/Mat Saltbush Community.

	NUMBER/ACRE*
Artemisia nova	893.32
Atriplex gardneri	1,914.25
Atriplex confertifolia	1,148.55
Atriplex corrugata	723.16
Chrysothamnus nauseosus	127.62
Chrysothamnus viscidiflorus	1,744.10
Ephedra viridis	42.54
Eriogonum corymbosum	127.62
Suaeda torreyana	85.08
TOTAL	6,806.25

* Sample size was 40 (n=40) and insured that 80% accuracy within 10% of the true mean.

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TABLE 7 Species list for the Gardner Saltbush/Mat Saltbush Community.

SCIENTIFIC NAME	COMMON NAME
SHRUBS	
Artemisia nova	Black sagebrush
Atriplex gardneri var. cuneata	Castle Valley saltbrush
Atriplex confertifolia	Shadscale
Atriplex corrugata	Mat saltbush
Chrysothamnus nauseosus	Rubber rabbitbrush
Chrysothamnus viscidiflorus	Low rabbitbrush
Ephredra viridis	Mormon tea
Eriogonum corymbosum	Corymb buckwheat
Juniperus osteosperma	Utah juniper
Pinus edulis	Pinyon pine
Sarcobatus vermiculatus	Greasewood
Tetradymia spinosa	Cottonthorn horsebrush
FORBS	
Cryptantha flava	Cryptantha
Cymopterus purpureus	Spring parsley
Eriogonum gordonii	Gordon's buckwheat
Eriogonum jamesii	James wild buckwheat
Eriogonum sp.	Buckwheat
Haplopappus sp.	Goldenweed
Parthenium sp.	Parthenium
Phacelia crenulata	Phacelia
Phacelia sp.	Phacelia
GRASSES	
Elymus salinus	Salina wildrye
Oryzopsis hymenoides	Indian ricegrass
Sitanion hystrix	Squirreltail

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TABLE 8 Statistical summary sheet for the Gardner Saltbush/Mat Saltbush Community.

PROPOSED DISTURBED				
Total Living Cover	x = 39.05	s = 12.34	n = 20	NMin = 16.36
Density	x = 28.71	s = 15.76	n = 30	NMin = 49.06
Aspect	E,W,S			
Slope	2 - 21 deg.			
REFERENCE AREA				
Total Living Cover	x = 38.93	s = 14.79	n = 30	NMin = 23.49
Density	x = 27.51	s = 13.00	n = 40	NMin = 36.59
Aspect	E,W,S			
Slope	2 - 21 deg.			

Jaccards Similarity Coefficient = 80.77%

Student's t-value (cover) = 0.030
Degrees of freedom = 48
Significance level = N.S.

Student's t-value (density) = 0.349
Degrees of freedom = 68
Significance level = N.S.

x = sample mean, s = sample standard deviation,
n = sample size, NMin = Minimum sample size for statistical adequacy,
p = significance level, N.S. = nonsignificant

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United States Department of Agriculture
Soil Conservation Service
350 North 4th East
Price, Utah 84501

Huntington Power Plant
Huntington Canyon
Huntington, Utah

Dear Sir:

proposed waste rock storage facility (RC)

On June 4, 1987, I visited your reference areas for the ~~coh stockpiles~~ with Patrick Collins to determine production and range condition.

The chained reference area is in fair condition and the production of the site is about 800 lbs. per acre.

The reference area east of the chained area in the sagebrush grass area is in fair condition and producing about 500 pounds. The mature P.J. slope is in good condition and is producing about 75 to 100 lbs. of understory vegetation and about 800 to 900 lbs. of Pinyon Juniper.

The Mat Saltbush, Gardner Saltbush site is producing about 250 lbs. of vegetation and is in a low good condition.

George S. Cook
Range Conservationist
Soil Conservation Service
Price, Utah

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APPENDIX 3-2

Survey of Revegetation Success on
Access Road Cut and Fill Slopes

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COVER COMPARISONS:
DEER CREEK WASTE ROCK
ACCESS ROAD VS. REFERENCE AREA

APPENDICE XIII

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COVER COMPARISONS:
DEER CREEK WASTE ROCK
ACCESS ROAD VS. REFERENCE AREA

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Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
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(801) 489-6937

by
Patrick Collins Ph.D.

for

PACIFICORP
Post Office Box 310
Huntington, Utah 84528

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March 22, 1997

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COVER COMPARISONS:
DEER CREEK WASTE ROCK
ACCESS ROAD VS. REFERENCE AREA

INTRODUCTION

A request was made by representatives from Pacificorp to compare the vegetation of a native plant community with the reseeded "fill" slopes created by construction of the access road at the Deer Creek Waste Rock Site. The purpose of the comparison may be to evaluate whether or not the revegetated fill slopes of the road is equal-to-or-greater-than a given standard. If the vegetation of the two areas were comparable, consideration could be made for the removal of the existing erosion control structures that are maintained in the area.

METHODS

Two data sets from earlier reports both done by *MT. NEBO SCIENTIFIC, INC.* were used to make comparisons. First, quantitative sampling results were taken from the "Pacificorp Vegetation Monitoring" (1995) report. The second data set used was from the original report of the vegetation communities before the waste rock site was constructed. This report was called "Vegetation of the Proposed Waste Rock Storage Areas" (1987). When the vegetation was sampled on the area that was proposed for

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disturbance for construction of the waste rock site in 1987, a reference area was also sampled to be used as a standard for future revegetation success. Sampling methods between data sets were similar, so comparisons could easily be made.

RESULTS

Data summaries for the vegetation of the access road of the Deer Creek Waste Rock Site and a Gardner Saltbush/Mat Saltbush Reference Area are shown on Tables A through E. Table A is a spreadsheet that shows all the cover data from the roadside, including both "cut" and "fill" slopes. Table B is a summary showing only the fill slopes. From Table B, one can see that the total living cover of the fill slopes is 32.44%. The total ground cover, or that cover that contributes to erosion control, was 74.17%. Total ground cover included total living cover, litter and rock (excluded bareground).

Tables D and E are data summaries taken from the aforementioned 1987 report for the Gardner Saltbush/Mat Saltbush Reference Area. From Table D, the total living cover of the reference area was 38.93%, whereas the total ground cover was 54.83%.

The total ground cover of the revegetated cut slopes of the access road at the waste rock site was obviously much greater than the cover of the reference area. It is therefore probable that erosion of the reseeded fill slopes does not exceed the erosion from the adjacent undisturbed slopes of the native plant communities.

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TABLE A - DEER CREEK-WASTE ROCK SITE
Access Road Slope
1989 Interim Reveg Area
Acreage: part of 5 acres
Slope: 20-25 deg
Exposure: variable
Sample Date: 28 Aug 1995

	Fill 1.00	Cut 2.00	Fill 3.00	Cut 4.00	Fill 5.00	Cut 6.00	Fill 7.00	Cut 8.00
SHRUBS								
Chrysothamnus nauseosus	20.00	5.00	5.00	0.00	0.00	0.00	0.00	0.00
Ceratoides lanata	0.00	0.00	0.00	5.00	10.00	0.00	0.00	0.00
Atriplex canescens	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00
Atriplex gardneri	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00
Eriogonum corymbosum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
FORBS								
Medicago sativa	5.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
Kochia scoparia	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00
Iva axillaris	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00
Salsola pestifer	0.00	0.00	0.00	30.00	0.00	0.00	0.00	5.00
Halogeton glomeratus	0.00	0.00	0.00	0.00	0.00	20.00	0.00	5.00
Penstemon palmeri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machaeranthera canescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES								
Stipa hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus cinereus	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sitanion hystrix	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus lanceolatus	10.00	30.00	25.00	0.00	20.00	5.00	30.00	0.00
COVER								
Total Living Cover	40.00	60.00	40.00	35.00	40.00	25.00	40.00	25.00
Litter	5.00	5.00	5.00	5.00	5.00	3.00	5.00	2.00
Bareground	25.00	30.00	20.00	55.00	40.00	70.00	10.00	70.00
Rock	30.00	5.00	35.00	5.00	15.00	2.00	45.00	3.00
% COMPOSITION								
Shrubs	50.00	8.33	12.50	14.29	50.00	0.00	25.00	60.00
Forbs	12.50	41.67	25.00	85.71	0.00	80.00	0.00	40.00
Grasses	37.50	50.00	62.50	0.00	50.00	20.00	75.00	0.00

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DEER CREEK-WASTE ROCK
Access Road Slope
1989 Interim Reveg Area
Acreage: part of 5 acres
Slope: 20-25 deg
Exposure: variable
Sample Date: 28 Aug 1995

Fill 9.00	Cut 10.00	Fill 11.00	Cut 12.00	Mean	SDev	
						SHRUBS
15.00	0.00	5.00	0.00	4.17	6.40	Chrysothamnus nauseosus
0.00	0.00	0.00	0.00	1.25	2.98	Ceratoides lanata
0.00	10.00	0.00	0.00	1.67	3.73	Atriplex canescens
0.00	0.00	0.00	0.00	0.83	2.76	Atriplex gardneri
0.00	0.00	0.00	0.00	1.25	4.15	Eriogonum corymbosum
						FORBS
0.00	0.00	0.00	0.00	0.83	1.86	Medicago sativa
0.00	0.00	0.00	0.00	0.83	2.76	Kochia scoparia
0.00	0.00	0.00	0.00	1.67	5.53	Iva axillaris
0.00	0.00	25.00	20.00	6.67	10.87	Salsola pestifer
0.00	0.00	0.00	0.00	2.08	5.57	Halogeton glomeratus
10.00	0.00	0.00	0.00	0.83	2.76	Penstemon palmeri
0.00	10.00	0.00	0.00	0.83	2.76	Machaeranthera canescens
						GRASSES
10.00	0.00	0.00	0.00	0.83	2.76	Stipa hymenoides
0.00	0.00	0.00	0.00	0.42	1.38	Elymus cinereus
0.00	0.00	5.00	0.00	0.42	1.38	Sitanion hystrix
0.00	0.00	0.00	0.00	10.00	12.08	Elymus lanceolatus
				23.33 (excluding annuals)		
						COVER
35.00	20.00	35.00	20.00	34.58	10.70	Total Living Cover (11.25% from annuals)
5.00	10.00	5.00	5.00	5.00	1.78	Litter
40.00	65.00	20.00	70.00	42.92	21.36	Bareground
20.00	5.00	40.00	5.00	17.50	15.31	Rock
						% COMPOSITION
42.86	50.00	14.29	0.00	27.27	20.96	Shrubs
28.57	50.00	71.43	100.00	44.57	32.20	Forbs
28.57	0.00	14.29	0.00	28.15	25.57	Grasses

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TABLE B - DEER CREEK-WASTE ROCK SITE
Access Road Slope
1989 Interim Reveg Area
Acreage: part of 5 acres
Slope: 20-25 deg
Exposure: variable
Sample Date: 28 Aug 1995

	Fill 1.00	Fill 3.00	Fill 5.00	Fill 7.00	Fill 9.00	Fill 11.00	Mean	SDev
SHRUBS								
Chrysothamnus nauseosus	20.00	5.00	0.00	0.00	15.00	5.00	7.50	7.50
Ceratoides lanata	0.00	0.00	10.00	0.00	0.00	0.00	1.67	3.73
Atriplex canescens	0.00	0.00	0.00	10.00	0.00	0.00	1.67	3.73
Atriplex gardneri	0.00	0.00	10.00	0.00	0.00	0.00	1.67	3.73
Eriogonum corymbosum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORBS								
Medicago sativa	5.00	0.00	0.00	0.00	0.00	0.00	0.83	1.86
Kochia scoparia	0.00	10.00	0.00	0.00	0.00	0.00	1.67	3.73
Iva axillaris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salsola pestifer	0.00	0.00	0.00	0.00	0.00	25.00	4.17	9.32
Halogeton glomeratus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penstemon palmeri	0.00	0.00	0.00	0.00	10.00	0.00	1.67	3.73
Machaeranthera canescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES								
Stipa hymenoides	0.00	0.00	0.00	0.00	10.00	0.00	1.67	3.73
Elymus cinereus	5.00	0.00	0.00	0.00	0.00	0.00	0.83	1.86
Sitanion hystrix	0.00	0.00	0.00	0.00	0.00	5.00	0.83	1.86
Elymus lanceolatus	10.00	25.00	20.00	30.00	0.00	0.00	14.17	11.70
COVER								
Total Living Cover	40.00	40.00	40.00	40.00	35.00	35.00	38.33	2.36
Litter	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00
Bareground	25.00	20.00	40.00	10.00	40.00	20.00	25.83	10.96
Rock	30.00	35.00	15.00	45.00	20.00	40.00	30.83	10.57
% COMPOSITION								
Shrubs	50.00	12.50	50.00	25.00	42.86	14.29	32.44	15.85
Forbs	12.50	25.00	0.00	0.00	28.57	71.43	22.92	24.32
Grasses	37.50	62.50	50.00	75.00	28.57	14.29	44.64	20.41
COVER (TLC+L+R)*	75.00	80.00	60.00	90.00	80.00	80.00	74.17	10.96

5.84 cover from annual

32.49

TLC = Total Living Cover
L = Litter
R = Rock

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TABLE C - DEER CREEK-WASTE ROCK SITE
Access Road Slope
1989 Interim Reveg Area
Acreage: part of 5 acres
Slope: 20-25 deg
Exposure: variable
Sample Date: 28 Aug 1995

	Cut 2.00	Cut 4.00	Cut 6.00	Cut 8.00	Cut 10.00	Cut 12.00	Mean	SDev
SHRUBS								
Chrysothamnus nauseosus	5.00	0.00	0.00	0.00	0.00	0.00	0.83	1.86
Ceratoides lanata	0.00	5.00	0.00	0.00	0.00	0.00	0.83	1.86
Atriplex canescens	0.00	0.00	0.00	0.00	10.00	0.00	1.67	3.73
Atriplex gardneri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eriogonum corymbosum	0.00	0.00	0.00	15.00	0.00	0.00	2.50	5.59
FORBS								
Medicago sativa	5.00	0.00	0.00	0.00	0.00	0.00	0.83	1.86
Kochia scoparia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iva axillaris	20.00	0.00	0.00	0.00	0.00	0.00	3.33	7.45
Salsola pestifer	0.00	30.00	0.00	5.00	0.00	20.00	9.17	11.70
Halogeton glomeratus	0.00	0.00	20.00	5.00	0.00	0.00	4.17	7.31
Penstemon palmeri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machaeranthera canescens	0.00	0.00	0.00	0.00	10.00	0.00	1.67	3.73
GRASSES								
Stipa hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus cinereus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sitanion hystrix	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus lanceolatus	30.00	0.00	5.00	0.00	0.00	0.00	5.83	10.96
COVER								
Total Living Cover	60.00	35.00	25.00	25.00	20.00	20.00	30.83	13.97
Litter	5.00	5.00	3.00	2.00	10.00	5.00	5.00	2.52
Bareground	30.00	55.00	70.00	70.00	65.00	70.00	60.00	14.43
Rock	5.00	5.00	2.00	3.00	5.00	5.00	4.17	1.21
% COMPOSITION								
Shrubs	8.33	14.29	0.00	60.00	50.00	0.00	22.10	23.95
Forbs	41.67	85.71	80.00	40.00	50.00	100.00	66.23	23.33
Grasses	50.00	0.00	20.00	0.00	0.00	0.00	11.67	18.63
COVER (TLC+L+R)*	70.00	45.00	30.00	30.00	35.00	30.00	40.00	14.43

*
TLC = Total Living Cover
L = Litter
R = Rock

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TABLE D - The reference area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover and composition with standard deviations and sample sizes.

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZES
Total Living Cover*	38.93	14.79	30
Litter	8.40	5.01	30
Rock	7.50	6.63	30
Bareground	45.33	17.21	30
COMPOSITION			
Shrubs	84.09	24.91	30
Forbs	1.13	3.05	30
Grasses	14.78	24.70	30

* Sample size insures 80% accuracy within 10% of the true mean.

COVER (TLC+L+R) = 54.83

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TABLE E - The reference area of the Gardner Saltbush/Mat Saltbush Community. The table shows the mean percent cover, standard deviation, sample size and relative frequency by species.

SPECIES	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE	RELATIVE FREQUENCY
SHRUBS				
Artemisia nova	6.50	11.23	30	30.00
Atriplex gardneri	11.37	17.17	30	46.67
Atriplex confertifolia	4.23	7.85	30	36.67
Atriplex corrugata	.57	3.10	30	3.33
Chrysothamnus nauseosus	.17	.91	30	3.33
Chrysothamnus viscidiflorus	6.10	6.82	30	53.33
Ephedra viridis	.50	2.74	30	6.67
Eriogonum corymbosum	2.33	5.86	30	26.67
FORBS				
Cryptantha flava	.07	.25	30	10.00
Cymopterus purpureus	.17	.91	30	6.67
Phacelia crenulata	.07	.25	30	6.67
GRASSES				
Elymus salinus	3.50	8.11	30	16.67
Oryzopsis hymenoides	2.70	5.53	30	30.00

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MT NEBO SCIENTIFIC, INC.
research & consulting

May 23, 1996

Val Payne
ENERGY WEST MINING COMPANY
P.O. Box 310
Huntington, Utah 84528

RE: Deer Creek Waste Rock Site

Dear Val:

Enclosed please find a spreadsheet showing the cover data of the Deer Creek Waste Rock Access Road. I have shown which of the quadrats were "fill" and which were "cut" slopes. At the bottom of the page you may note that the mean total cover (vegetation, litter & rock) was 74.17% for the fill slopes and 40.00% for the cut slopes.

I hope this information is what you needed. Please do not hesitate to call if you have questions or need further assistance.

Sincerely,

Patrick D. Collins, Ph.D.

Enclosure

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330 East 400 South, Ste. 6, P.O. Box 337, Springville, Utah 84663
(801) 489-6937, (fax) 489-6779

MT. NEBO SCIENTIFIC/ ENERGY WEST RAW DATA SUMMARY 1995

EER CREEK-WASTE ROCK SITE

ccess Road Slope

1989 Interim Reveg Area

Acreage: part of 5 acres

Slope: 20-25 deg

Exposure: variable	Fill	Cut	Fill	Cut	Fill	Cut	Fill	Cut	Fill	Cut	Fill	Cut
Sample Date: 28 Aug 1995	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00
SHRUBS												
Chrysothamnus nauseosus	20.00	5.00	5.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	5.00	0.00
Ceratoides lanata	0.00	0.00	0.00	5.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atriplex canescens	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	10.00	0.00	0.00
Atriplex gardneri	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eriogonum corymbosum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00
FORBS												
Medicago sativa	5.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kochia scoparia	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iva axillaris	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salsola pestifer	0.00	0.00	0.00	30.00	0.00	0.00	0.00	5.00	0.00	0.00	25.00	20.00
Halogeton glomeratus	0.00	0.00	0.00	0.00	0.00	20.00	0.00	5.00	0.00	0.00	0.00	0.00
Penstemon palmeri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00
Machaeranthera canescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00
RASSES												
stipa hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00
Elymus cinereus	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sitanion hystrix	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
Elymus lanceolatus	10.00	30.00	25.00	0.00	20.00	5.00	30.00	0.00	0.00	0.00	0.00	0.00
COVER												
Total Living Cover	40.00	60.00	40.00	35.00	40.00	25.00	40.00	25.00	35.00	20.00	35.00	20.00
Litter	5.00	5.00	5.00	5.00	5.00	3.00	5.00	2.00	5.00	10.00	5.00	5.00
Bareground	25.00	30.00	20.00	55.00	40.00	70.00	10.00	70.00	40.00	65.00	20.00	70.00
Rock	30.00	5.00	35.00	5.00	15.00	2.00	45.00	3.00	20.00	5.00	40.00	5.00
% COMPOSITION												
Shrubs	50.00	8.33	12.50	14.29	50.00	0.00	25.00	60.00	42.86	50.00	14.29	0.00
Forbs	12.50	41.67	25.00	85.71	0.00	80.00	0.00	40.00	28.57	50.00	71.43	100.00
Grasses	37.50	50.00	62.50	0.00	50.00	20.00	75.00	0.00	28.57	0.00	14.29	0.00
Total Cover	75.00	70.00	80.00	45.00	60.00	30.00	90.00	30.00	60.00	35.00	80.00	30.00
Bareground	25.00	30.00	20.00	55.00	40.00	70.00	10.00	70.00	40.00	65.00	20.00	70.00

Mean Total Cover: Fill Slopes **74.17** Std.Dev. **10.96**

an Total Cover: Cut Slopes **40.00** Std.Dev. **14.43**

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DEER CREEK-WASTE R
Access Road Slope
1989 Interim Reveg Area
Acreage: part of 5 acres
Slope: 20-25 deg
Exposure: variable
Sample Date: 28 Aug 1995

Mean	SDev	Freq	
			SHRUBS
4.17	6.40		Chrysothamnus nauseosu
1.25	2.98		Ceratoides lanata
1.67	3.73		Atriplex canescens
0.83	2.76		Atriplex gardneri
1.25	4.15		Eriogonum corymbosum
			FORBS
0.83	1.86		Medicago sativa
0.83	2.76		Kochia scoparia
1.67	5.53		Iva axillaris
6.67	10.87		Salsola pestifer
2.08	5.57		Halogeton glomeratus
0.83	2.76		Penstemon palmeri
0.83	2.76		Machaeranthera canescen
			GRASSES
0.83	2.76		Stipa hymenoides
0.42	1.38		Elymus cinereus
0.42	1.38		Sitanion hystrix
10.00	12.08		Elymus lanceolatus
			COVER
34.58	10.70		Total Living Cover
5.00	1.78		Litter
42.92	21.36		Bareground
17.50	15.31		Rock
			% COMPOSITION
27.27	20.96		Shrubs
44.57	32.20		Forbs
28.15	25.57		Grasses
57.08	21.36		
42.92	21.36		

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APPENDIX 3-3

Correspondence from the Utah Division of Wildlife Resources
Regarding the Revegetation Seed Mix

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STATE OF UTAH
NATURAL RESOURCES
Wildlife Resources

1596 West North Temple • Salt Lake City, UT 84116-3154 • 801-533-9333

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
William H. Geer, Division Director

June 10, 1988

Dr. Dianne R. Nielson, Director
Utah Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

Attn: John Whitehead

Dear Dianne:

The Division has evaluated Utah Power and Light Company's plans titled "Deer Creek Waste Rock Storage Facility". The development operation and mitigation strategy adequately addresses impacts to wildlife. It is recommended that the interim revegetation seed list (page 3-6) and the final revegetation seed list (page 3-8) be modified to include ladak alfalfa (1 lb./acre) and Great Basin sagebrush (0.5 lb/acre). Also, the streambank wheatgrass should be replaced with Basin wildrye. These vegetation species will likely establish under the reclaimed conditions and will enhance the site for big game use.

Thank you for an opportunity to review the MRP and provide comment.

Sincerely,

William H. Geer
Director

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From: **Makeda Hanson** <makedatrujillo@utah.gov>
Date: Fri, Nov 13, 2015 at 11:31 AM
Subject: Re: Deer Creek Waste Rock Pile
To: Lisa Reinhart <lreinhart@utah.gov>

Hi Lisa,

Below is a list of plants and pounds/acre that I would use for a reseeding in this area.

Indian Ricegrass (cool-season)	1 lb
Thickspike Wheatgrass (cool-season)	0.5 lb
Salina Wildrye (cool-season)	0.5 lbs
Galleta (warm-season)	0.5 lbs
Sanberg blue grass (cool-season)	1 lb

Globemallow	0.5 lbs
Western Yarrow (seed tiny-seed low rate)	0.01 lbs
Annual sunflower	1 lb
Lewis Flax (or blue flax (non-native))	1 lb
Rocky Mountain Bee Plant	1 lb
Palmer Penstemon	0.5 lbs

Winter fat	0.5 lbs
Four wing saltbush	1 lb
Wyoming big sagebrush	1 lb

Non-native forb subsitutues	
Forage kochia	0.5 lbs
Alfalfa	1 lb
Yellow sweetclover	0.5 lb

Makeda Trujillo Hanson
Impact Analysis Biologist
Utah Division of Wildlife Resources
319 N. Carbonville Rd. Suite A
Price, UT 84501
Cell: 435-630-0805
Fax: 435-613-3704

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APPENDIX 3-4

IPaC Resource Report and
Section 7 Letter

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U.S. Fish & Wildlife Service

Deer Creek Waste Rock Site

IPaC Trust Resource Report

Generated November 10, 2015 04:44 PM MST

This report is for informational purposes only and should not be used for planning or analyzing project-level impacts. For projects that require FWS review, please return to this project on the IPaC website and request an official species list from the Regulatory Documents page.

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US Fish & Wildlife Service

IPaC Trust Resource Report

Project Description

NAME

Deer Creek Waste Rock Site

PROJECT CODE

JCAUO-KW2Y5-B25M5-RBH4V-UZVWOY

LOCATION

Emery County, Utah

DESCRIPTION

Deer Creek Waste Rock Site- Coal recovery from waste

U.S. Fish & Wildlife Contact Information

Species in this report are managed by:

Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
(801) 975-3330

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Endangered Species

Proposed, candidate, threatened, and endangered species that are managed by the Endangered Species Program and should be considered as part of an effect analysis for this project.

This unofficial species list is for informational purposes only and does not fulfill the requirements under Section 7 of the Endangered Species Act, which states that Federal agencies are required to "request of the Secretary of Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action." This requirement applies to projects which are conducted, permitted or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can be obtained by returning to this project on the IPaC website and requesting an official species list on the Regulatory Documents page.

Birds

Mexican Spotted Owl Strix occidentalis lucida — Threatened

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B074

Southwestern Willow Flycatcher Empidonax traillii extimus — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B094

Yellow-billed Cuckoo Coccyzus americanus — Threatened

CRITICAL HABITAT
There is **proposed** critical habitat designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06R

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Fishes

Bonytail Chub Gila elegans — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E020

Colorado Pikeminnow (=squawfish) Ptychocheilus lucius — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E006

Humpback Chub Gila cypha — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E000

Razorback Sucker Xyrauchen texanus — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E054

Flowering Plants

Barneby Reed-mustard Schoenocrambe barnebyi — Endangered

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=Q2QU

Jones Cycladenia Cycladenia humilis var. jonesii — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=Q1V7

Critical Habitats

Potential effects to critical habitat(s) within the project area must be analyzed along with the endangered species themselves.

There is no critical habitat within this project area

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Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity which results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service (1). There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

You are responsible for complying with the appropriate regulations for the protection of birds as part of this project. This involves analyzing potential impacts and implementing appropriate conservation measures for all project activities.

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B008

Black Rosy-finch Leucosticte atrata — Bird of conservation concern
Year-round

Brewer's Sparrow Spizella breweri — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0HA

Burrowing Owl Athene cunicularia — Bird of conservation concern
Season: Breeding

Cassin's Finch Carpodacus cassinii — Bird of conservation concern
Year-round

Ferruginous Hawk Buteo regalis — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06X

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Breeding

Golden Eagle Aquila chrysaetos — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0DV

Juniper Titmouse Baeolophus ridgwayi — Bird of conservation concern
Year-round

Lewis's Woodpecker Melanerpes lewis — Bird of conservation concern
Year-round

Loggerhead Shrike Lanius ludovicianus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0FY

Long-billed Curlew Numenius americanus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06S

Olive-sided Flycatcher Contopus cooperi — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0AN

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Peregrine Falcon Falco peregrinus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0FU

Pinyon Jay Gymnorhinus cyanocephalus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0I0

Prairie Falcon Falco mexicanus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0ER

Sage Thrasher Oreoscoptes montanus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0ID

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0HD

Swainson's Hawk Buteo swainsoni — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B070

Williamson's Sapsucker Sphyrapicus thyroideus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0FX

Willow Flycatcher Empidonax traillii — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0F6

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Refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. If your project overlaps or otherwise impacts a Refuge, please contact that Refuge to discuss the authorization process.

There are no refuges within this project area

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Wetlands

Impacts to NWI wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes.

Project proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

There are no wetlands identified in this project area

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UT 84119
PHONE: (801)975-3330 FAX: (801)975-3331
URL: www.fws.gov; www.fws.gov/utahfieldoffice/

Consultation Code: 06E23000-2016-SLI-0037 November 10, 2015
Event Code: 06E23000-2016-E-00081
Project Name: Deer Creek Waste Rock Site

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

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A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

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United States Department of Interior
Fish and Wildlife Service

Project name: Deer Creek Waste Rock Site

Official Species List

Provided by:

Utah Ecological Services Field Office
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UT 84119
(801) 975-3330
http://www.fws.gov
http://www.fws.gov/utahfieldoffice/

Consultation Code: 06E23000-2016-SLI-0037
Event Code: 06E23000-2016-E-00081

Project Type: MINING

Project Name: Deer Creek Waste Rock Site
Project Description: Deer Creek Waste Rock Site- Coal recovery from waste

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

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United States Department of Interior
Fish and Wildlife Service

Project name: Deer Creek Waste Rock Site

Project Location Map:

Project Coordinates: MULTIPOLYGON (((-111.05633638487454 39.38117899369903, -111.05816338306447 39.37788066354506, -111.05892741192856 39.37690373356715, -111.06294101642708 39.373671433359796, -111.06316867307744 39.37388265707028, -111.061240598567 39.375686393957814, -111.05994597384931 39.37838974291772, -111.05996027991043 39.378456175961944, -111.06061756129677 39.378915125396055, -111.06154436561637 39.37925645868107, -111.06246012509035 39.37946955655784, -111.06345594854263 39.37956173378352, -111.06345692980231 39.380385762391825, -111.06338380980878 39.381209309799175, -111.05633638487454 39.38117899369903)))

Project Counties: Emery, UT

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United States Department of Interior
Fish and Wildlife Service

Project name: Deer Creek Waste Rock Site

Endangered Species Act Species List

There are a total of 9 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	Status	Has Critical Habitat	Condition(s)
Mexican Spotted owl *(Strix occidentalis lucida)* Population: Entire	Threatened	Final designated	
Southwestern Willow flycatcher *(Empidonax traillii extimus)* Population: Entire	Endangered	Final designated	
Yellow-Billed Cuckoo *(Coccyzus americanus)* Population: Western U.S. DPS	Threatened	Proposed	
Fishes			
Bonytail chub *(Gila elegans)* Population: Entire	Endangered	Final designated	
Colorado pikeminnow *(Ptychocheilus lucius)* Population: Entire, except EXPN	Endangered	Final designated	
Humpback chub *(Gila cypha)* Population: Entire	Endangered	Final designated	
Razorback sucker *(Xyrauchen*	Endangered	Final designated	

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texanus) Population: Entire			
Flowering Plants			
Barneby reed-mustard *(Schoenocrambe barnebyi)*	Endangered		
Jones Cycladenia *(Cycladenia humilis var. jonesii)*	Threatened		

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United States Department of Interior
Fish and Wildlife Service

Project name: Deer Creek Waste Rock Site

Critical habitats that lie within your project area

There are no critical habitats within your project area.

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APPENDIX 3-5

Estimated Project Water Usage

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Estimated Water Usage for Dust Suppression (Windy Gap Process)

Site: **Deer Creek Waste Rock Recovery**

Equation: $C = 100 - \frac{0.8\ p\ d\ t}{i}$

Where
- C = Average control efficieny (%)
- p = Potential average hourly daytime evaporation rate (mm/hr)
  - = (0.0065) x (annual pan evaporation rate for summaer conditions)
- d = Average hourly daytime traffic rate (trips/hr)
- t = Time between applications (hr)
- I = Application intensity (L/m^2)

Source of equations and pan evaporation data:

Cowherd, C., G.E. Muleski, and J.S. Kinsey. 1988. Control of Open Fugitice Dust Sources: Final Report. EPA-4150/3-98-008. U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Mean annual Class A pan evap. =	55	inches	
Potential average hourly daytime evap. rate =	0.3575	mm/hr	
Average hourly daytime traffic rate =	10	trips/hr	
Water application intensity =	1	L/m^2 =	0.025 gal/ft^2
Time between applications =	5	hr	
Average control efficiency =	85.7	%	

Water Requirement:

	Length	Width	Area	Water Required (gal)	
Area	(ft)	(ft)	(ft^2)	Per App	Daily
Work area	100	100	10,000	250	500
Road	400	15	6,000	150	300

TOTAL DAILY WATER REQUIREMENT = 800 gal/day

6 months (26 weeks) of operation at 5 days/wk = 104,000 gallons
= 0.32 acre-feet

Assume 5 times as much water usage during reclamation (for dust suppression and compaction moisture conditioning)
= 520000 gallons
= 1.60 acre-feet

TOTAL ESTIMATED WATER USAGE
= **624,000 gallons**
= **1.92 acre-feet**

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CHAPTER 4
LAND USE AND AIR QUALITY

4.10 Land Use

4.1.1 Environmental Description

4.1.1.1 Premining Land Use

Prior to disturbance of the area by Energy West for use as a waste rock disposal facility, land within the permit area was used as wildlife habitat. Since the late 1980s the land has been used for mining purposes (i.e., disposal of waste rock generated from the Deer Creek Mine).

Land Use Map. Zoning boundaries in Emery County are provided on the map contained in Appendix 4-1. Zoned land use north of State Route 31 in the permit and adjacent areas is M&G-1 (mining and grazing). Land on the south side of State Route 31 near the permit area is zoned A-1 (agricultural).

Land Capability. Information presented in Chapter 2 of this application indicates that soils in the permit area are generally saline and are categorized as having a Class 8 capability, which indicates that they have limitations that preclude commercial plant production and restricting their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes. Information presented in Chapter 3 of this application indicates that vegetative cover is generally sparse in the area.

Land Use Description. The Emery County Zoning Ordinance[1] indicates that the M&G-1 zone "*generally covers the dry mountain and desert areas of the County. Because of the limitations imposed by climate, topography, soil capability, inadequate water supply, and the*

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[1] http://www.emerycounty.com/b&z/index.htm, downloaded 22 Jan 2015

presence of economically significant mineral deposits, this area has historically been utilized as a place for the grazing of livestock on the open range and as the location of numerous mining and mineral exploration sites. The peculiar characteristics and conditions present in this area make the land most appropriately suited for a continuation of these uses."

The proposed operations of BRC Wellington ("BRCW") will benefit the region by recovering coal from the waste rock that was previously disposed of at the site. These activities will be in accordance with the M&G-1 zoning as described above.

Cultural and Historic Resources Information. A cultural resource inventory of the permit area was conducted in April 1987 prior to disturbance of the site for waste rock disposal. The results of this survey, conducted by F.R. Hauck, Ph.D. of Archeological-Environmental Research Corporation are provided in Appendix 4-2. The survey included on-site evaluations, a search of the National Register of Historic Places, a search of the files of the Price Area office of the U.S. Bureau of Land Management, and a search of records on files with the Utah State Historic Preservation Office. Dr. Hauck concluded that "no cultural resources or site were observed or recorded during the evaluation." The State Historic Preservation Office reviewed their files, including the information prepared by Dr. Hauck, and concluded that "there appears to be a low probability for impacting any historic resources as a result of this project" (see Appendix 4-2).

4.1.1.2 Previous Mining Activity

Mining activity, in the form of waste-rock disposal, has occurred in the permit area since the late 1980s. This activity has been conducted in accordance with a permit issued by the Utah Division of Oil, Gas and Mining to PacifiCorp and/or its predecessors or agents. The original approval for disposing of waste rock at the site was issued on September 13, 1988 (see Appendix 4-3).

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Additional information regarding past mining activities at the site is available in the files of the Division under Permit No. ACT/015/018. The permit area has been used only for the disposal of waste rock. No coal has been mined in the permit area. Land in the permit area was used prior to mining activities primarily for wildlife habitat.

4.1.2 Reclamation Plan

4.1.2.1 Postmining Land Use Plan

As indicated in Section 2.2.2.4 of this application, the soil at the site is poorly suited for agricultural use. Even under favorable conditions, the soils in the permit area can produce only 63 pounds of rangeland vegetation per acre annually. As a result, these soils are categorized as having a Class 8 capability, which indicates that they have limitations that preclude commercial plant production and restricting their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes. Given these conditions, the reclamation plan has been designed to support a post-mining land use of wildlife habitat (i.e., the same as the pre-disturbance land use). This use is consistent with local zoning as indicated in Section 4.1.1.1 of this application. This post-mining land use will be achieved through the following actions:

- Regrading of the area in a manner that provides a roughened, final soil surface, thereby minimizing the potential for erosion, maximizing the retention of water, and substantially improving revegetation success; and
- Reseeding the area with an appropriate mix of native and introduced plant species that will provide forage for big-game animals.

The methods to be employed during site reclamation, following operations, are discussed more fully in Section 5.40 of this permit application. In developing the reclamation plan, consideration has been given to ensuring that the plan is consistent with county zoning ordinances and compatible with adjacent land uses.

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4.1.2.2 Land Owner or Surface Manager Comments

BRCW owns and will conduct operations at the site. Thus, surface land owner comments are not required. All operations will be conducted in accordance with applicable local, State, and Federal regulations.

4.1.2.3 Suitability and Capability

Final fills will not contain excess spoils.

4.1.3 Performance Standards

4.1.3.1 Postmining Land Use

The proposed post-operations land use will be wildlife habitat. The land is capable of supporting such a land use as evidenced by that fact that it supported this land use prior to disturbance.

4.1.3.2 Determining Premining Uses of Land

The pre-mining land use within the permit area was for wildlife habitat.

4.1.3.3 Criteria for Alternative Postmining Land Uses

No alternative post-mining land uses are anticipated.

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4.1.4 Alternative Land Use

No alternative post-mining land uses are anticipated.

4.20 Air Quality

This section includes descriptions of plans to comply with the Clean Air Act and applicable Utah or federal statutes and regulations pertaining to air quality standards.

4.2.1 Air Quality Standards

BRCW will conduct operations at the site in compliance with the requirements of the Clean Air Act and the Utah Air Quality Regulations.

4.2.2 Compliance Efforts

Approval by the Utah Division of Air Quality is provided in Appendix 4-4 for the operations that will be conducted at the site. Controls will be implemented at the site to suppress dust through such actions as watering roadways, material-handling operations, and loading operations. Storage piles will also be sprayed with water as necessary to minimize dust emissions.

4.2.3 Monitoring Program

Air quality monitoring at the site will be conducted in accordance with requirements established by the Utah Division of Air Quality, following their review of site operation plans, as discussed in Appendix 4-4. These monitoring requirements were promulgated by the Utah Division of Air Quality to comply with applicable Utah and federal air quality standards.

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APPENDIX 4-1

Emery County Zoning Boundaries

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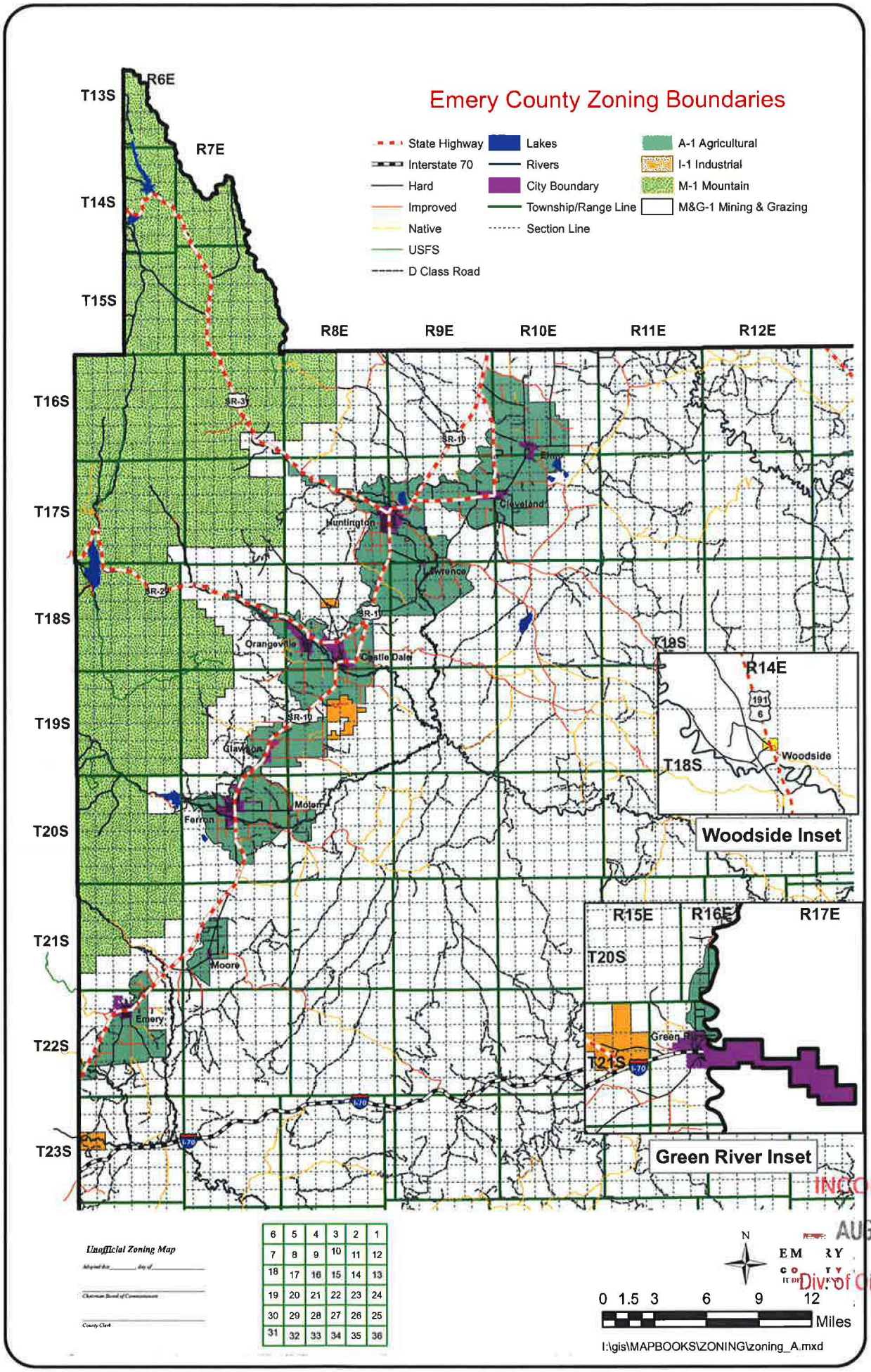

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

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APPENDIX 4-2

Cultural Resource Inventory

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Bureau of Land Management
Utah State Office
(AERC FORMAT)

Summary Report of
Inspection for Cultural Resources

1 10

Report Acceptable Yes __ No __

Mitigation Acceptable Yes __ No __

Comments:_____

_____

W A S T E R O C K D I S P O S A L S I T E

1. Report Title . . . . . Utah Power & Light Co., Parcel in Huntington Canyon

2. Development Company_____

3. Report Date 04 15 1987 (41 42 43 46) 4. Antiquities Permit No. 87-UT-54937

5. Responsible Institution AERC UPL-87-2 (47) County Emery (61)

6. Fieldwork Location: TWN 17S (62 65) RNG 08E (66 69) Section 05 06 (70 71 72 73 74 75 76 77)

7. Resource Area .P.R. (110 111) TWN . . . . . (78 81) RNG . . . . . (82 85) Section. . . . . (86 87 88 89 90 91 92 93)

(94 97 98 101 102 104 106 108)

8. Description of Examination Procedures:
The archeologist, F.R. Hauck, walked a series of 15 to 20 meter wide transects within the large parcel. The existing access road was also examined on each flank by walking 15 meter wide transects. As a result this roadway can be upgraded for 50 additional feet on either side of the existing road.

9. Linear Miles Surveyed and/or Definable Acres Surveyed and/or Legally Undefinable Acres Surveyed 5 (112 117) (118 123) 70 (124 129)

10. Inventory Type . . I (130)
R = Reconnaissance
I = Intensive
S = Statistical Sample

11. Description of Findings:
No cultural resources or sites were observed or recorded during the evaluation.

12. Number Sites Found .0. . . . . (No sites = 0) (131 135)

13. Collection: .N. (Y = Yes, N = No) (136)

14. Actual/Potential National Register Properties Affected:
The National Register of Historic Places (NRHP) has been consulted and no registered properties will be affected by the proposed development.

15. Literature Search, Location/ Date: Utah SHPO - 4-13-87
Price Area BLM Office - 4-14-87

16. Conclusion/ Recommendations:
AERC recommends that a cultural resource clearance be granted to Utah Power & Light Company based upon adherence to the following stipulations: (see next page)

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17. Signature of Administrator & Field & Field Supervisor

Administrator F. R. Hauck

Field Supervisor F. R. Hauck

UT 8100-3
(2/85)

16. continued:

1. All vehicular traffic, personnel movement, and construction should be confined to the locations examined as referenced in this report, and to the existing roadways and/or evaluated access routes.

2. All personnel should refrain from collecting artifacts and from disturbing any cultural resources in the area.

3. The authorized official should be consulted should cultural remains from subsurface deposits be exposed during construction work or if the need arises to relocate or otherwise alter the location of the construction area.

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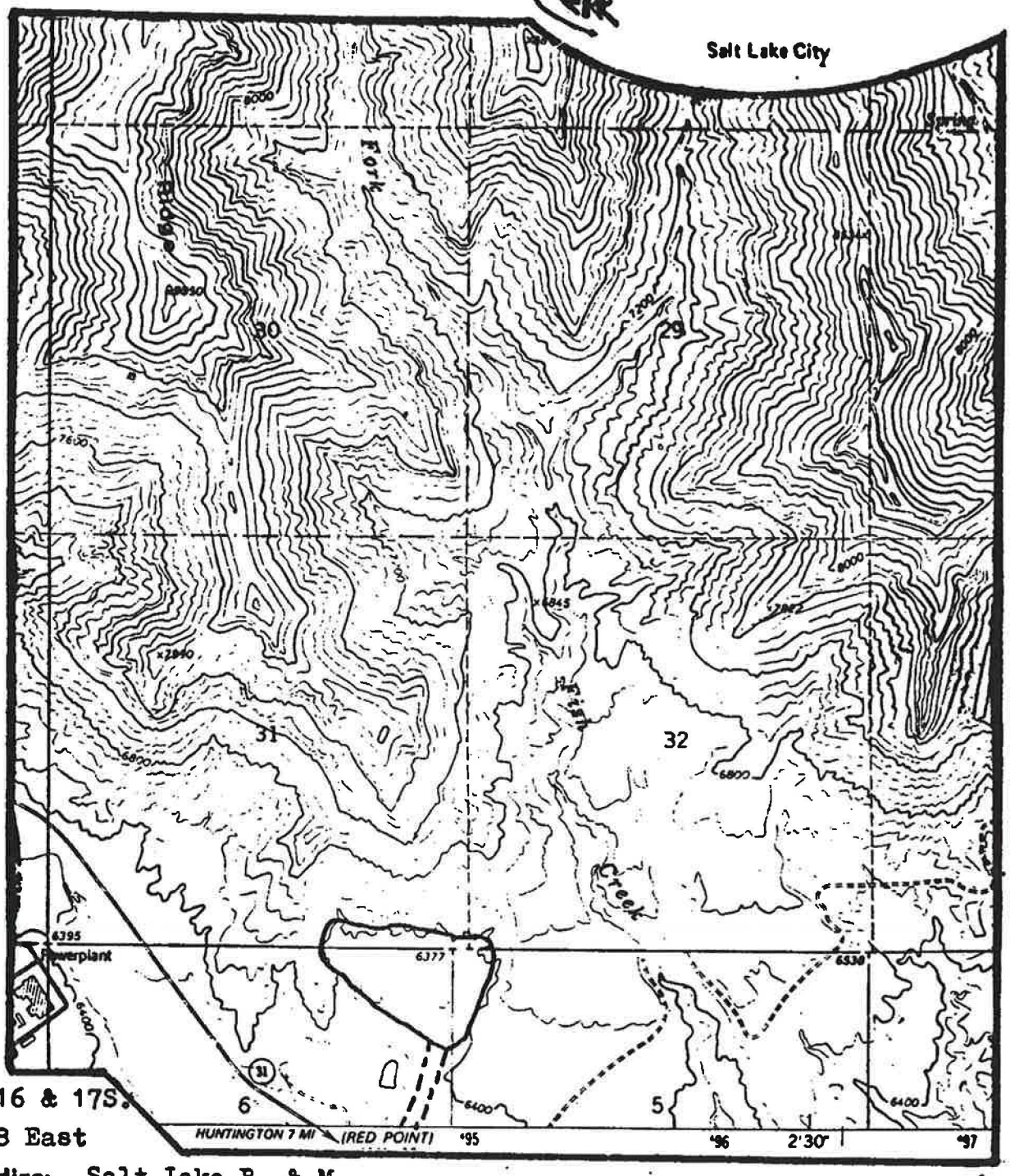
ARCHEOLOGICAL-ENVIRONMENTAL RESEARCH CORPORATION

Salt Lake City



T. 16 & 17S.

R. 8 East

Meridian: Salt Lake B. & M.

Quad: Hiawatha, Utah 7.5 minute-USGS

Project: UPL-87-2

Series: Central Utah

Date: 4-15-87

Cultural Resource Survey of a Waste Rock Disposal Location in the Huntington Canyon Locality of Emery County, Utah

Legend:

Intensive Survey Area

Access Corridor

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2.64" = 1 mile
Scale

0041

file ACT/015/018 #2

State of Utah
Division of State History
(Utah State Historical Society)
Department of Community and Economic Development

Norman H. Bangerter
Governor
Max J. Evans
Director

300 Rio Grande
Salt Lake City, Utah 84101-1182

RECEIVED
AUG 3 1988
DIVISION OF
OIL, GAS & MINING

August 1, 1988

Mr. L. P. Braxton
Administration
Division of Oil, Gas and Mining
355 West North Temple, Suite 350
Salt Lake City, Utah 84180-1203

RE: Determination of Completeness, Waste Rock Disposal Site, Utah Power and Light Company, Deer Creek Mine, (ACT/015/018, Folder No. 2), Emery County, Utah (UT880630-020)

In Reply Please Refer to Case No. L470

Dear Mr. Braxton:

The staff of the Utah State Historic Preservation Office has received the above referenced project. Following a review of our files, it appears as if a portion of the current waste rock disposal site for UP&L was surveyed for historical and archaeological resources in 1987, with negative results. If the current proposal is an expansion of the existing waste rock disposal site, there appears to be a low probability for impacting any historic resources as a result of this project, based on the results of previous surveys in the vicinity. The Division of Oil, Gas and Mining, or Utah Power and Light, can use this information in making any further recommendations regarding the project.

The above is provided on request as outlined by 36 CFR 800 or Utah Code, Title 63-18-37. If you have questions or need additional assistance, please contact me at (801) 533-7039, or 533-6017.

Sincerely,

Diana Christensen
Regulation Assistance Coordinator

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DC:L470/5846V

cc: Chairperson, Resource Development Coordinating Committee, State Planning Office, 118 State Capitol, Salt Lake City, Utah 84114

Board of State History: Thomas G. Alexander, Chairman • Dean L. May, Vice Chairman • Douglas D. Alder
Phillip A. Bullen • Ellen G. Callister • J. Eldon Dorman • Hugh C. Garner • Dan E. Jones • Leonard J. Arrington • Amy Allen Price • Sunny Redd

APPENDIX 4-3

1988 DOGM Approval of the
Deer Creek Waste Rock Facility

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Div. of Oil, Gas & Mining

0022

Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Dianne R. Nielson, Ph.D.
Division Director

State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340

October 12, 1988

Emery County Progress
Box 1870
76 West Main Street
Price, Utah 84501

Ladies and Gentlemen:

Re: Notice of Permit Approval, Utah Power and Light Company, Waste Rock Disposal Site, Deer Creek Mine, ACT/015/018, Folder #3, Emery County, Utah

Enclosed is a Notice of Permit Approval rendered by the Division of Oil, Gas and Mining, Department of Natural Resources, state of Utah.

It is requested that this notice be published ONCE ONLY, as soon as possible.

Upon completion of this request, please send proof of publication and statement of cost to the Division of Oil, Gas and Mining, 3 Triad Center, Suite 350, 355 West North Temple, Salt Lake City, Utah 84180-1203.

Sincerely,

Lowell P. Braxton
Administrator
Mineral Resource Development
and Reclamation Program

JJW/djh
Enclosure
A7/67

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Div. of Oil, Gas & Mining

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Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Dianne R. Nielson, Ph.D.
Division Director

State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340

October 12, 1988

Newspaper Agency Corporation
Legal Advertising
143 South Main Street-Mezzanine Floor
Salt Lake City, Utah 84110

Ladies and Gentlemen:

Re: Notice of Permit Approval, Utah Power and Light Company, Waste Rock Disposal Site, Deer Creek Mine, ACT/015/018, Folder #3, Emery County, Utah

Enclosed is a Notice of Permit Approval rendered by the Division of Oil, Gas and Mining, Department of Natural Resources, state of Utah.

It is requested that this notice be published ONCE ONLY, as soon as possible.

Upon completion of this request, please send proof of publication and statement of cost to the Division of Oil, Gas and Mining, 3 Triad Center, Suite 350, 355 West North Temple, Salt Lake City, Utah 84180-1203.

Sincerely,

Lowell P. Braxton
Administrator
Mineral Resource Development
and Reclamation Program

JJW/djh
Enclosure
A7/68

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NOTICE OF PERMIT APPROVAL

To Whom It May Concern:

Pursuant to the Utah Coal Mining and Reclamation Act (Utah Code Annotated 1953, Section 40-10-1 et seq), and the "Regulations Pertaining to Surface Effects of Underground Coal Mining Activities" (Final Rules of the Utah Board of Oil, Gas and Mining), the Utah Division of Oil, Gas and Mining has issued a permit for a Waste Rock Disposal Site to Utah Power and Light Company for its permit application No. ACT/015/018. The Company will conduct mining activities in accordance with the approved Mining and Reclamation Plan for the Waste Rock Disposal Site associated with the following lands:

Township 17 South, Range 8 East, SLBM

Section 5: NW NW Lot 4
SW NW Lot 5

Section 6: NE NE Lot 1
SE NE
SW NE

The permit was issued by the Utah Division of Oil, Gas and Mining on September 13, 1988. A copy of the permit, the Decision Document and Technical Analysis is on file at the following location:

Division of Oil, Gas and Mining
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Anyone having comments pertaining to the Deer Creek Mine should contact Dr. Dianne R. Nielson, Director, Utah Division of Oil, Gas and Mining, at the address referenced above.

JJW/djh
A7/69

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Div. of Oil, Gas & Mining

APPENDIX 4-4

Utah Division of Air Quality Approval

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AUG 11 20
Div. of Oil, Gas & Mining

State of Utah
GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

March 16, 2016

DAQC-286-16
Site 14239 (B1)

Galen W. Williams
EarthFax Engineering Group
7324 South Union Park Avenue #100
Midvale, Utah 84047

Dear Mr. Williams:

Re: EarthFax Engineering Group - Temporary Relocation/Operation, Notice of Intent – Emery County

Your Notice of Intent dated March 4, 2016, to relocate portable aggregate equipment to the temporary project located at the Deer Creek Waste Rock Storage Site, State Hwy 31, Huntington, Utah, was received by the Utah Division of Air Quality (DAQ) and has been reviewed.

The following equipment has been approved for operation for this temporary project:

Metso-Lokotrack LLT1213S 77882 portable crusher
C-13 KWJ01245 310 kW crusher diesel engine

Approval is granted to relocate and operate this equipment at the new location for a period not to exceed 180 operational days. As per Utah Administrative Code (UAC) R307-401-17, the operation of equipment at this temporary site may be for up to 180 working days in any calendar year not to exceed 365 consecutive days, starting from the initial relocation date. The operational days per site cannot be extended beyond the stipulated 365 consecutive day period. Approval is subject to the conditions of the dust control plan submitted for this location and the current Wheeler Machinery Company Approval Order (AO) DAQE-AN142390010-15 dated April 8, 2015. Hours of operation shall be held to 16 hours per each 24-hour day. The maximum production rate shall be held to the requested 350 tons per hour. Emissions for this project have been estimated at the following:

Pollutant	gram/sec	lbs/hr	lbs/24 hr	tons/yr
PM10	1.47	11.66	116.60	9.10
SOx	0.55	4.40	44.05	3.44
NOx	3.72	29.55	295.46	23.05
CO	0.99	7.88	78.83	6.15
VOC	0.16	1.24	12.44	0.97

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The owner/operator shall maintain records of the actual operation hours of the above referenced equipment at this relocation site and have the ability to submit the information to the DAQ upon the request of representatives of the Director. Please make certain that the plant operator is aware of all the location specific requirements for this site and the conditions of the aforementioned AO.

NSPS Subpart OOO requires that initial Method 9 observations be performed for all applicable portable crushers, screens and attached conveyors. Subpart OOO also mandates that all crushers constructed, modified, or reconstructed on or after April 22, 2008, which are not enclosed, must install spray bars on the equipment and keep maintenance records to ensure proper spray bar operations.

Utah Division of Water Quality Storm Water Permits and regulations may apply to this temporary project. Please refer to https://secure.utah.gov/deq-dashboard/index.html for additional information.

This approval for relocation in no way releases the owner or operator from any liability for compliance with all other applicable federal, state, and local regulations including the UAC.

If you have any questions regarding this relocation authorization or the temporary relocation process please contact Susan Weisenberg at (801) 536-4045.

Sincerely,

Rusty Ruby, Manager
Compliance Branch

RR:SPW:bp

Enclosure: Submitted Temporary Relocation Form

cc: Southeastern Utah District Health Department

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Div. of Oil, Gas & Mining

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

Utah Division of Air Quality

CK# 2083
$130.00

Notice of Temporary Relocation of Portable Equipment
Form 15a

In accordance with Utah Administrative Code (UAC) R307-401-17, the following information must be submitted to the Division in order to evaluate a temporary relocation of equipment.

Contact Person	Galen W. Williams
Company Name	EarthFax Engineering Group
Mailing Address	7324 South Union Park Avenue, Suite 100
City, State, Zip	Midvale, Utah 84047
Phone Number	801-561-1555
Email Address	gwilliams@earthfax.com

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
MAR 07 2016
DIVISION OF AIR QUALITY

PROPOSED RELOCATION INFORMATION

Site address or brief directions to find the site:
Deer Creek Waste Rock Storage Site State Highway 31 near the Huntington Power Plant

Closest City Huntington County Emery

UTM Coordinate of site: 494673.51 E., 4358973.65 N, Zone 12S

Approximate distance to the nearest house or business:
0.6 Mile South (Figure 1)

UTM Coordinates of the nearest house or business:
494544.18 E., 4358016.99 N., Zone 12S

Is this site permitted by the Division of Air Quality? (Yes or No). If yes, please provide permit holder's name and the permit number, if known
No

Attach a site diagram showing the equipment layout and general site dimensions to this relocation request.

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In an effort to coordinate state and local regulations, please provide the name of the issuing agency and the date of any Conditional Use Permits issued for this project N/A.

Total hours of operation per 24 hour period 16 starting at 06:00 am am/pm ending at 10:00 pm am/pm.
Maximum hourly production rate for project 350 TPH
Expected Startup Date: April 1, 2016 Expected Completion Date: March 31, 2017

Existing Approval Orders permitting the equipment or permitting the relocation site (e.g. DAQE-XXXXXXX-XX) DAQE-AN142390010-15

Equipment Type: Portable Crusher Make/Model Metso-Lokotrack LLT1213S Serial or ID # 77882 Manufactured Date 03-2014 Design Capacity 350 TPH	Equipment Type: Crusher Diesel Engine Make/Model C-13 Serial or ID # KWJ01245 Manufactured Date 03-2014 Design Capacity 310kW/415 HP
Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity	Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity
Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity	Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity
Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity	Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity
Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity	Equipment Type: Make/Model Serial or ID # Manufactured Date Design Capacity

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FUGITIVE DUST CONTROL PLAN

Utah Administrative Code (UAC) 307-309-6 requires that any person owning or operating a source of fugitive dust within PM10 and PM2.5 non-attainment and maintenance plan areas on cleared land greater than one-quarter acre in size must submit a completed Fugitive Dust Control Plan.

DAQ Fugitive Dust Control Plans for temporary projects in these areas can be found on line at: https://secure.utah.gov/deq-dashboard/index.htm

The program requires that you have an account with Utah.gov. If you do not have a Utah.gov account, you will need to create one. The first time you access the program and click on "Start a New Permit", you will be directed to a login page. Please select "Create an Account". Creating a Utah.gov account only takes a few minutes and will only be required once. After you have a username and password with Utah.gov, return to the above web address and login to complete the Storm Water Permit and FDCP application. When completed, enter the FDCP permit number below:

FDCP Permit# Not Applicable - Deer Creek Waste Rock Site in in Emery County, which is an Attainment Area

Temporary projects that are not located within PM10 and PM2.5 non-attainment and maintenance plan areas may submit a formal FDCP application or complete the following indicating how the operators will address all applicable sources of fugitive dust.

1. Material storage See attached narrative. Only storage will be non-coal rock already stored at the waste rock site.
2. Material handling See attached narrative. Material to be loaded directly to trucks from crusher and leave the site.
3. Material processing See attached narrative and Figure 2.
4. Road ways and yard areas See attached narrative for roadway dust control
5. Loading, hauling, and dumping materials See attached narrative.
6. Drilling, blasting, and pushing See attached narrative. There will be no drilling or blasting.
7. Clearing, leveling, and excavation There will be no clearing, leveling or excavation other than into rock piles.
8. Tailing piles and ponds N/A
9. Exposed surfaces See attached narrative. Exposed surfaces are only inside the waste rock site.
10. Surface mining operations See attached narrative.

16. Owner/Operator Representative Justin THompson - VP Operations, Bowie Resource Partners	
Signature Justin Thompson	3/2/16 Date

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BOWIE REFINED COAL-WELLINGTON
DEER CREEK WASTE ROCK RECLAMATION
APPLICATION FOR TEMPORARY RELOCATION OF PORTABLE EQUIPMENT

NARRATIVE OF PROPOSED PROCESSES AND EQUIPMENT TO BE USED THAT IS SUBJECT TO EMISSIONS REGULATIONS AND SITE CONTROLS

1.0 INTRODUCTION AND PURPOSE

This narrative is provided as supplemental information to the attached request for approval of Temporary Relocation of Portable Equipment (Utah DAQ Form 15A). Bowie Refined Coal plans to relocate a portable crusher to recover coal from 362,000 tons of waste rock currently stored at the Deer Creek Waste Rock Site. As shown on Figure 1, the site is located approximately six miles northwest of Huntington, Utah at UTM coordinates 494673.51 E., 4358973.65 N., Zone 12 S in Emery County, Utah. The nearest house is 0.6 miles southwest of the waste rock site and the closest city is Huntington.

Crushing activities will be conducted using a mobile crusher provided by Wheeler Machinery in Salt Lake City, Utah. The unit is a Meso-Lokotrack 350 TPH LT1213S, Serial Number 77882 that was manufactured in March 2014. The power plant mounted to the unit is a Caterpillar C-13, 415 HP/310 kW diesel fueled engine. As required by DEQ for portable or re-locatable machinery, the LT1213 (engine and crusher) provided by Wheeler is permitted separately under DAQE-AN142390008-14 (Attached). It is understood that under the Form 15A application process the only fuel emissions and PM calculations that must be submitted for the Deer Creek Waste Rock Site during the planned period of operation are for the crusher and its power plant. Spreadsheets with these calculations are provided as attached Tables 1 and 2. For specific details on the screens, fuel requirements, engine performance and emission control measures as well as DAQ forms 11 and 15 related to the crusher and engine, reference is made to the above Approval Order.

The other equipment planned for use at this site consists of diesel powered, double capacity trucks making 40 to 100 round trips per day, a CAT 336F Hydraulic Excavator and a CAT 980M, rubber tired front end ("RTFE") loader to feed the crusher from the stockpile.

2.0 PROCESS AND SEQUENCE

Approximately 362,000 tons of waste rock are currently stored at the Deer Creek site. It is anticipated that re-processing will yield approximately 217,200 tons (60%) of coal with approximately 114,800 tons of waste rock (40%) remaining at the site. The sequence of events is as detailed below and shown on the attached flow diagram (Figure 2). Figure 3 shows the waste rock site, topography, exit entrance road and typical layout of the crusher, excavator, loader and trucks.

- The LT1213S Crusher will be set up at an optimal location within the first work area.
- The 336F Excavator will pull material from the stockpile and load it into the crusher.

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- The 980M RTFE loader will move material from around the area into the stockpile pile to maintain a workable size supply pile for the excavator to feed the crusher.

3.0 DURATION

At the Deer Creek site the only unpaved area within which the portable crusher will travel is inside the waste rock site. If needed, the most effective dust control method is treatment with a salt solution, most likely magnesium chloride or calcium chloride. Tests have shown that the use of magnesium chloride can create an efficient rating of 95% for up to 22 days after application (USBM, 1987)[1]. Re-application is simple with the frequency dependant on total traffic load wear and any precipitation that could bring the chloride into solution and runoff. Chlorides also absorb moisture from the atmosphere and tend to maintain travelable, lower dust moisture content in the haul road surface soils.

[1] USBM, [1987]. Fugitive Dust Control for Haulage Roads and Tailings. Olson KS & Veith DL. US Bureau of Mines.

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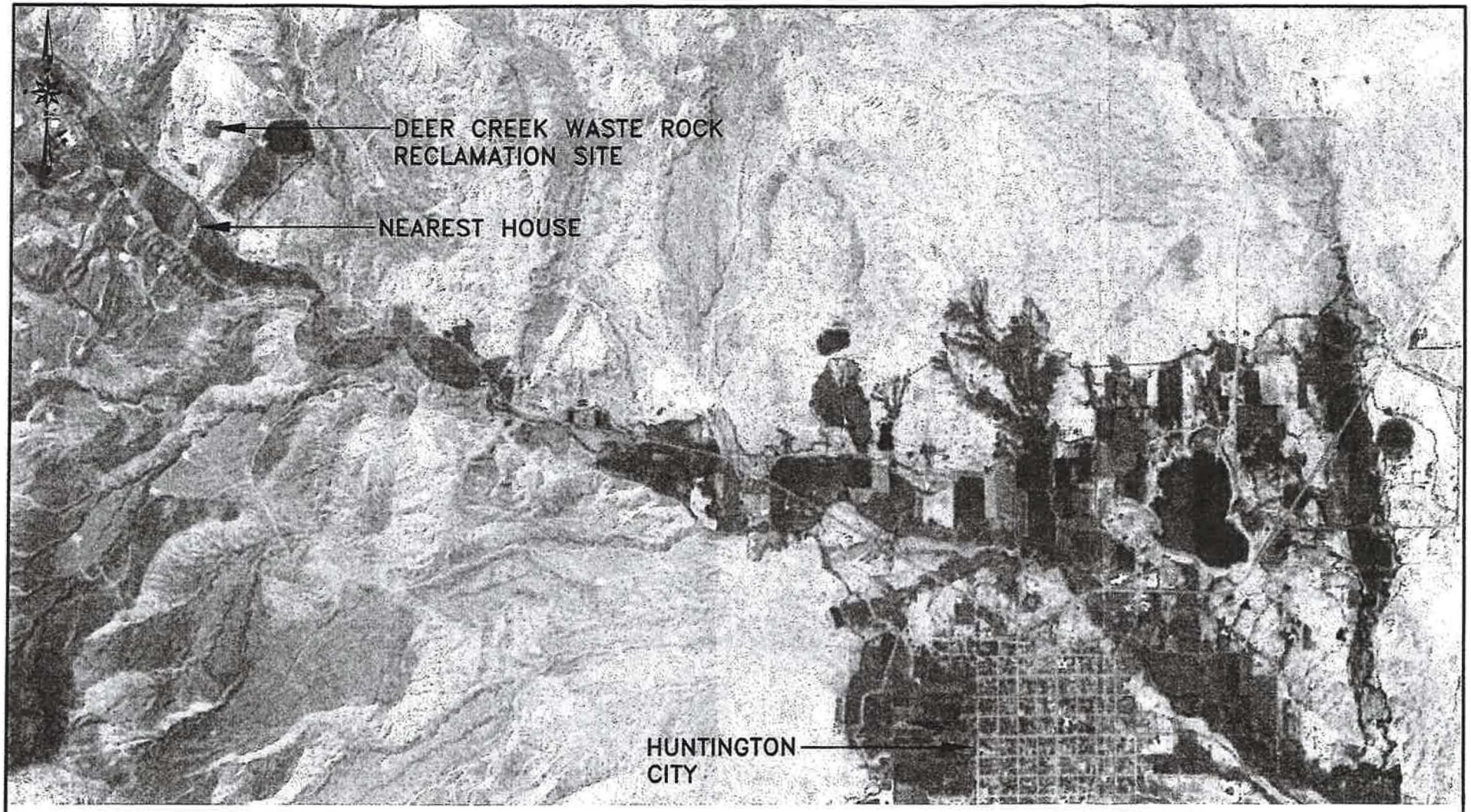

FIGURE 1 – DEER CREEK WASTE ROCK RECLAMATION LOCATION MAP

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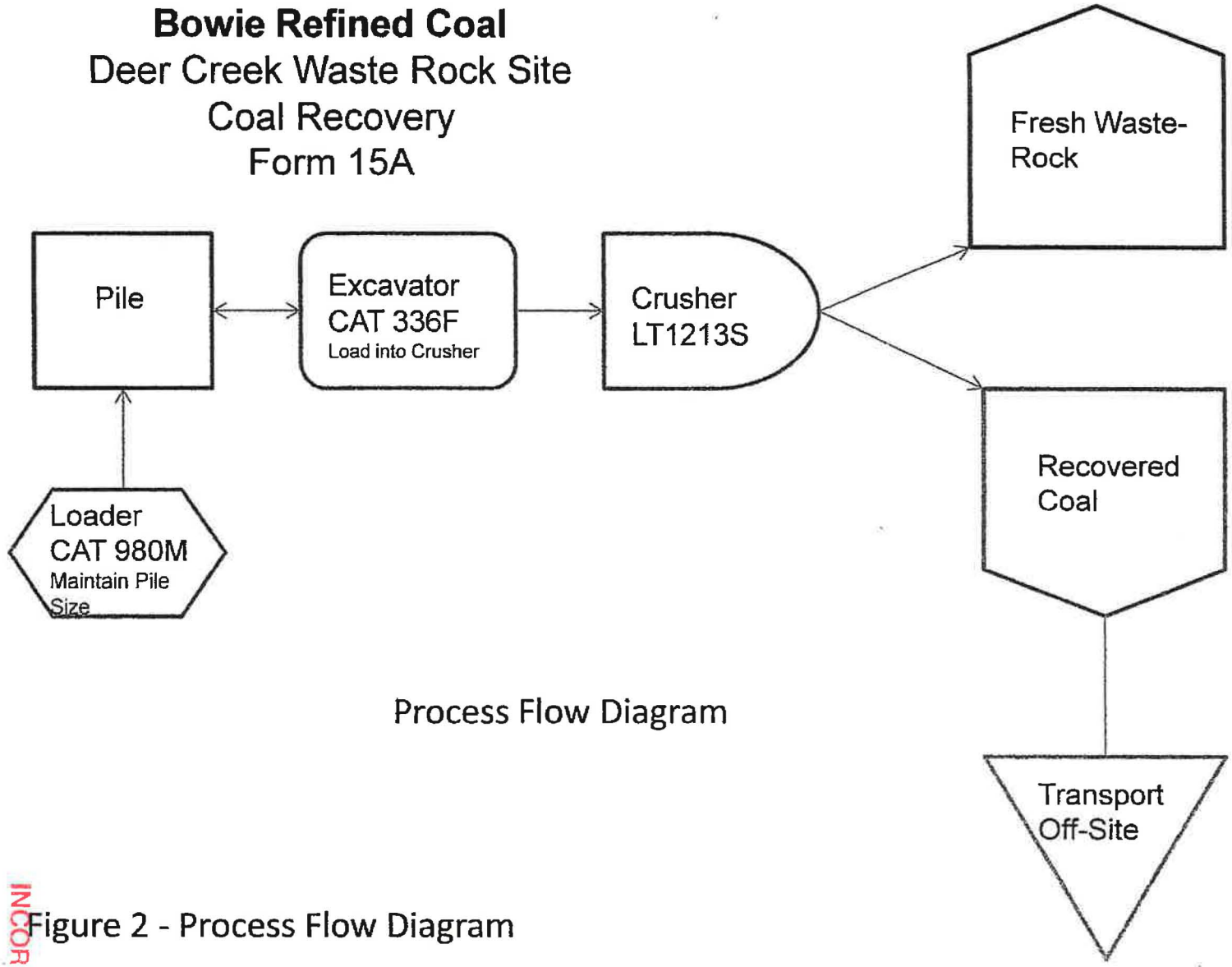

Figure 2 - Process Flow Diagram

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BASE MAP GOOGLE EARTH 8-17-15

0' 100'

LEGEND

- CRUSHER WITH CAT C-13 415 HP DIESEL ENGINE. THIS IS A PERMIT REGULATED ENGINE EXHAUST EMISSION SOURCE
- EXCAVATOR CAT 336F HYDRAULIC EXCAVATOR
- LOADER CAT 980M RUBBER TIRE FRONT END LOADER
- DOUBLE TRUCK - 42 TON CAPACITY

EQUIPMENT LOCATION AND ORIENTATION SHOWN IS TYPICAL. MOBILE CRUSHER AND SUPPORT EQUIPMENT WILL RELOCATE TO AREAS OF RECOVERABLE COAL AS NEEDED THROUGHOUT THE OPERATION

NOTES:

UTM 494544.18 E., 4358016.99 N.
ZONE 12S
APPROXIMATELY 6 MILES NW OF HUNTINGTON, EMERY COUNTY, UTAH

AVERAGE SURFACE ELEVATION 6344 FT. ASL. WASTE ROCK STORAGE SITE IS APPROXIMATELY 3.0 ACRES

362,000 TONS OF WASTE ROCK
EST 217,200 TONS RECOVERABLE (60%)
EST 144,800 TONS BACK TO WASTE PILE (40%)

FIGURE 3 - DEER CREEK WASTE ROCK RECLAMATION SITE PLAN

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TABLE 1 - Deer Creek Waste Rock Site

Gasoline & Diesel Industrial Engines

Company: BRC
Site: Deer Creek
Date: March 1, 2016

Note: SO_2 Calculated using DAQ AP42 Template. Caterpillar does not provide these values. See explanation page for deatails.

	PM_{10} tons/yr	SO_2 tons/yr	NO_X tons/yr	CO tons/yr	Lead tons/yr	PM_{10} - F tons/yr	PM_{10} - NF tons/yr	$PM_{2.5}$ tons/yr	VOC tons/yr	HAP's tons/yr	CO_2 eq. tons/yr
Uncontrolled	0.86	0.80	12.17	2.62			0.86	0.86	0.99	0.01	453
PTE/Controlled	0.86	0.80	12.17	2.62			0.86	0.86	0.99	0.01	453

Diesel Industrial Engine

1,900 hours/year
415 hp
7,000 BTU/hp-hr
2,905 MMBTU/hr

	lb/MMBtu	lbs/hr	tons/year	lb/hp-hr	lbs/hr	tons/year	
NO_X	4.41	12.81	12.17	3.10E-02	12.87	12.22	AP-42 Table 3.3-1
CO	0.95	2.76	2.62	6.68E-03	2.77	2.63	AP-42 Table 3.3-1
PM_{10}	0.31	0.90	0.86	2.20E-03	0.91	0.87	AP-42 Table 3.3-1
$PM_{2.5}$	0.31	0.90	0.86	2.20E-03	0.91	0.87	AP-42 Table 3.3-1
SO_2	0.29	0.84	0.80	2.05E-03	0.85	0.81	AP-42 Table 3.3-1
VOC	0.36	1.05	0.99	2.51E-03	1.04	0.99	AP-42 Table 3.3-1
CO_2	164	476	453	1.15	477	453	
CO_2 eq.			453			453	
HAPs	21.38	0.01	0.01	21.38	0.01	0.01	

HAP's	lb/MMBtu	lbs/year	lbs/hr	tons/year	AP-42 Table 3.3-2
Benzene	9.33E-04	5.15	2.71E-03	2.57E-03	
Toluene	4.09E-04	2.26	1.19E-03	1.13E-03	
Xylenes	2.85E-04	1.57	8.28E-04	7.87E-04	
1,3-Butadiene	3.91E-05	0.22	1.14E-04	1.08E-04	
Formaldehyde	1.18E-03	6.51	3.43E-03	3.26E-03	
Acetaldehyde	7.67E-04	4.23	2.23E-03	2.12E-03	
Acrolein	9.25E-05	0.51	2.69E-04	2.55E-04	
Naphthalene	8.48E-05	0.47	2.46E-04	2.34E-04	
Acenaphthylene	5.06E-06	0.03	1.47E-05	1.40E-05	
Acenaphthene	1.42E-06	0.01	4.13E-06	3.92E-06	
Fluorene	2.92E-05	0.16	8.48E-05	8.06E-05	
Phenanthrene	2.94E-05	0.16	8.54E-05	8.11E-05	
Anthracene	1.87E-06	0.01	5.43E-06	5.16E-06	
Fluoranthene	7.61E-06	0.04	2.21E-05	2.10E-05	
Pyrene	4.78E-06	0.03	1.39E-05	1.32E-05	
Benz(a)anthracene	1.68E-06	0.01	4.88E-06	4.64E-06	
Chrysene	3.53E-07	0.00	1.03E-06	9.74E-07	
Benzo(b)fluoranthene	9.91E-08	0.00	2.88E-07	2.73E-07	
Benzo(k)fluoranthene	1.55E-07	0.00	4.50E-07	4.28E-07	
Benzo(a)pyrene	1.88E-07	0.00	5.46E-07	5.19E-07	
Indeno(1,2,3-cd)pyrene	3.75E-07	0.00	1.09E-06	1.03E-06	
Dibenz(a,h)anthracene	5.83E-07	0.00	1.69E-06	1.61E-06	
Benzo(g,h,I)perylene	4.89E-07	0.00	1.42E-06	1.35E-06	
		21.38068	0.011253	0.01069	

LT1213 is a monile crusher producing 350 Tons Per Hour
Has a mister piped through the network.
Mobile crushers are considered mobile equipment but are they exempt from emissions like trucks, loaders and excavators.
Mobile crusher is 6am to 10 PM 180 days/year
Engine on crusher is 415 hp/310 kW.
Wheeler Machinery sending me emission and dust specs on cursher, dozer and loader. Trucks data calucated from the mine input.

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TABLE 2 - Deer Creek Waste Rock Site NOI

Aggregate Processing

Company: BRC
Site: Deer Creek
Date: March 1, 2016

	PM_{10} tons/yr	SO_2 tons/yr	NO_x tons/yr	CO tons/yr	Lead tons/yr	PM_{10} - F tons/yr	PM_{10} - NF tons/yr	$PM_{2.5}$ tons/yr	VOC tons/yr	HAP's tons/yr	CO_2 eq. tons/yr
Uncontrolled	0.38					0.38		0.11			
PTE/Controlled	0.06					0.06		0.01			

	PM_{10} lb/hr	SO_2 lb/hr	NO_x lb/hr	CO lb/hr	Lead lb/hr	PM_{10} - F lb/hr	PM_{10} - NF lb/hr	$PM_{2.5}$ lb/hr	VOC lb/hr	HAP's lb/hr
	1.23					1.23		0.37		
	0.21					0.21		0.04		

	Uncontrolled PM_{10}	Uncontrolled $PM_{2.5}$	Controlled PM_{10}	Controlled $PM_{2.5}$	(lb/ton)
Primary, Secondary, Tertiary Crushing	0.0025	0.00074	0.00054	0.00010	AP-42 Table 11.19.2-2
Fines Crushing	0.0160	0.0025	0.00120	0.00007	
Screening	0.0057	0.00261	0.00074	0.00005	
Fines Screening	0.0720	0.0218	0.00226	0.0011	
Conveyor Transfer Point	0.0011	0.0035	0.000046	0.000013	
Wet Drilling	0.00008	0.00024			
Truck Unloading - Fragmented Stone	0.000016	4.85-06			
Truck Unloading - Conveyor, Crushed Stone	0.00010	0.00003			

Controlled	Number	Yearly Amount (tons)	Hourly Rate (tons)	Uncontrolled PM_{10} Emissions tons/yr	Uncontrolled PM_{10} Emissions lb/hour	Controlled PM_{10} Emissions tons/yr	Controlled PM_{10} Emissions lb/hour	Uncontrolled $PM_{2.5}$ Emissions tons/yr	Uncontrolled $PM_{2.5}$ Emissions lb/hour	Controlled $PM_{2.5}$ Emissions tons/yr	Controlled $PM_{2.5}$ Emissions lb/hour
Times Crushed	1	217,200	350	0.26	0.84	0.06	0.19	0.08	0.25	0.01	0.04
Times Fine Crushed	0	217,200	350	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Times Screened	0	217,200	350	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Times Fine Screened	0	217,200	350	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Number of Transfer Points	1	217,200	350	0.12	0.39	0.00	0.02	0.04	0.12	0.00	0.00
Unloading	0	217,200	350	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emissions				0.38	1.23	0.06	0.21	0.11	0.37	0.01	0.04

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CHAPTER 5

ENGINEERING

5.10 Introduction

This chapter provides a discussion of general engineering aspects, an operation plan, a reclamation plan, design criteria, and performance standards related to the Deer Creek waste rock site (the "Deer Creek site" or the "site") as proposed by BRC Wellington LLC ("BRCW"). The existing and proposed facilities have been or will be designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plans.

It should be noted that this application is for recovery of coal from an existing waste rock pile and not for operation of a surface or underground coal mine. Thus, several of the sections in this chapter that refer to mining operations are not applicable and have been noted as such.

5.1.1 General Requirements

This permit application includes descriptions of the proposed operations for recovery of coal from waste rock at the Deer Creek site together with the appropriate maps, plans, and cross sections. Methods and calculations utilized to achieve compliance with the design criteria are also presented.

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5.1.2 Certification

Where required by the regulations, cross sections and maps in this permit application have been prepared by or under the direction of, and certified by, qualified registered professional engineers or land surveyors. As appropriate, these persons were assisted by experts in the fields of hydrology, geology, biology, etc.

5.1.2.1 Cross Sections and Maps

Previously Mined Areas. There are no previously mined areas near the facility.

Surface Facilities. A general site map is shown on Plate 5-1. This map includes the locations of topsoil and coal material stockpiles, runoff control structures, and sedimentation pond. Except for the sedimentation pond, no other water treatment facilities exist at the site. Other surface facility maps provided in this application are similarly certified.

The following facilities or activities do not exist or occur within the permit area:

- Excess spoil,
- Durable rock fills, and
- Disposal of non-coal (non-waste rock) waste

Surface Configurations. The topography noted on Plate 5-1 is based on a survey of the site performed in September 2014.

Hydrology. Certified maps and cross sections associated with the hydrology of the Deer Creek site are provided in Chapter 7.

Geology. A certified map and cross sections associated with the geology of the site is provided as Figure 6-1 of this application.

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5.1.2.2 Plans and Engineering Designs

All plans and engineering designs presented in this permit application were prepared by or under the direction of and certified by a qualified registered professional engineer.

Excess Spoil. No excess spoil will be generated from the permit area.

Durable Rock Fills. No durable rock fills will exist in the permit area.

Coal Mine Waste. The waste rock pile at the Deer Creek site was designed by a professional engineer with experience in the design of similar structures (see the Mining and Reclamation Plan for the Deer Creek Mine, DOGM identification number C0150018). The operations proposed in this application involve the recovery of coal from that site. No additional coal mine waste will be stored in the permit area, beyond that which existed at the time this application was submitted. Reject from the coal recovery operations will be temporarily stored as indicated in Section 5.2.2 and finally placed as indicated in Sections 5.2.8.3 and 5.3.6. Final compaction and reclamation of the reject material will occur as outlined in Section 5.4.2.2.

Impoundments. One impoundment is present at the site, located immediately west of the waste rock pile (see Plate 5-1). This impoundment (a sedimentation pond) was designed and certified by a professional engineer using current, prudent, engineering practices. The details of this design are presented in Chapter 7 of this application.

Primary Roads. The site access road is considered a primary road as defined in R645-301-527.120. This road has been certified by a professional engineer as meeting the requirements of R645-301-534.200 and R645-301-742.420 (see Appendix 5-1).

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Variance from Approximate Original Contour. The placement of waste rock at the site since the late 1980s has resulted in a change to the original contour of the site. BRCW plans to recover a substantial amount of the coal from the waste rock pile. However, non-coal rock and unrecoverable coal will remain at the site. It is the understanding of BRCW that a variance from the Approximate Original Contour requirements of the regulations is not required for waste rock sites due to the nature of such sites. Therefore, no variance request is submitted with this application.

5.1.3 Compliance with MSHA Regulations and MSHA Approvals

5.1.3.1 Coal Processing Waste Dams and Embankments

No coal processing waste dams or embankments exist within the permit area.

5.1.3.2 Impoundments and Sedimentation Ponds

No impoundments or sedimentation ponds in the permit area meet the size criteria of 30 CFR 77.216(a).

5.1.3.3 Underground Development Waste, Coal Processing Waste, and Excess Spoil

No underground development waste, coal processing waste, or excess spoil will be disposed of in underground mine workings the permit area.

5.1.3.4 Refuse Piles

The Deer Creek waste rock pile was designed and constructed in accordance with the requirements of the Mine Safety and Health administration as promulgated in 30 CFR 77.214 and 77.215.

5.1.3.5 Underground Openings to the Surface

There are no underground openings within the permit area.

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5.1.3.6 Discharges to Underground Mines

No discharges occur from the surface to underground mine workings in the permit area.

5.1.3.7 Surface Coal Mining and Reclamation Activities

The regulatory definition of "surface coal mining and reclamation activities" includes the "recovery of coal from a deposit that is not in its original geologic location" (see R645-100-200). None of the planned coal recovery operations within the permit area will occur within 500 feet of an active underground mine.

5.1.3.8 Coal Mine Waste Fires

If any coal-related fires occur within the permit area, these will be reported immediately to MSHA and DOGM. Immediate remedial action will be taken as deemed necessary by BRCW to protect public health and safety as well as the environment. Following initial remedial efforts, a long-term plan will be formulated in discussion with MSHA and DOGM to extinguish any existing fires and prevent future fires.

5.1.4 Inspections

5.1.4.1 Excess Spoil

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Excess spoil does not exist in the permit area.

5.1.4.2 Refuse Piles

The Deer Creek waste rock pile has been inspected at least quarterly by Energy West since construction of the pile began. Quarterly inspections of the pile will continue during coal recovery

operations and through the period of final grading and revegetation. A report of each inspection will be prepared by a qualified individual and provided to the Division after each inspection.

5.1.4.3 Impoundments

The sedimentation pond at the Deer Creek has been inspected at least quarterly by Energy West since construction of the pond. Quarterly inspections of the pond will continue during coal recovery operations and through the period of final grading and revegetation. A report of each inspection will be prepared by a qualified individual and provided to the Division after each inspection. This report will indicate whether or not the impoundment has been maintained as designed and in accordance with the approved plan and the R645 rules. The report will also include a discussion of any apparent instability, structural weakness or other hazardous conditions, approximate depth of impounded waters, existing storage capacity, existing or required monitoring procedures and instrumentation, and any other aspects of the structure affecting stability, as noted during the inspection. A copy of the inspection report will be maintained at the BRCW office in Wellington, Utah.

No impoundments that are subject to 30 CFR 77.216 currently exist or are planned within the permit area. If impoundments subject to 30 CFR 77.216 are constructed in the future, these impoundments will be inspected in accordance with 30 CFR 77.216-3.

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5.1.5 Reporting and Emergency Procedures

5.1.5.1 Slides

The potential for slides to occur in the permit area is extremely minimal. However, if a slide occurs within the permit area that may have a potential adverse effect on the public, property, health, safety, or the environment, BRCW will notify the Division by the fastest available means

following discovery of the slide and will comply with any remedial measures required by the Division.

5.1.5.2 Impoundment Hazards

If any examination or inspection of the sedimentation pond discloses that a potential hazard associated with that impoundment may have an adverse effect on the public, property, health, safety, or the environment, the person who examined the impoundment will promptly inform the Division of the finding and of the emergency procedures formulated for public protection and remedial action. If adequate procedures cannot be formulated or implemented, the Division will be notified immediately.

5.1.5.3 Temporary Cessation of Operations

Prior to a temporary cessation of operations within the permit area that will last for a period of 30 days or more or as soon as it is known that a temporary cessation will extend beyond 30 days, BRCW will submit to the Division a notice of intention to cease or abandon operations. This notice will include the following:

- A statement of the exact number of surface acres in the permit area prior to cessation of operations,
- A discussion of the extent and kind of reclamation activities which will have been accomplished prior to cessation of operations, and
- An identification of the regrading, revegetation, environmental monitoring, and water treatment activities that will continue during the temporary cessation.

During the temporary cessation, BRCW will support and maintain all surface access and will also secure all facilities. The gate at the entry to the site and the fence surrounding the site will be maintained. The gate will be closed and locked to prevent unauthorized access to the site.

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5.20 Operation Plan

5.2.1 General

5.2.1.1 Cross Sections and Maps

Previously Mined Areas. There are no active, inactive, or abandoned underground workings, including openings to the surface, within the permit and adjacent areas. No previously surface-mined areas exist within the permit area.

Existing Surface and Subsurface Facilities and Features. Plate 5-1 depicts the following information:

- Each public road located in or within 100 feet of the permit area,
- The location of soil stockpiles,
- The location of existing waste rock piles,
- The location of roads and drainage ditches, and
- The location of the sedimentation pond within the permit area.

Information regarding the dimension of the sedimentation pond is provided on Plate 7-1. Typical dimensions of drainage ditches UD-1 through UD-4 are noted on Plate 7-2. Typical dimensions of drainage ditches UD-5 through UD-7 are provided on Plate 5-1. Buildings located within 1,000 feet of the permit area are noted on Figure 5-1, including an identification of the current use of the buildings. No major electric transmission lines, pipelines, agricultural drainage tile fields, or similar surface and subsurface man-made features exist within, passing through, or passing over the permit area. No areas of spoil, non-coal waste disposal, permanent water impoundments, water treatment facilities, air pollution control facilities, coal processing waste dams, or coal processing embankments exist within the permit area. The only coal development waste located within the permit area is the waste rock pile noted on Plate 5-1.

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Landowner, Right-of-Entry, and Public Interest. Plate 5-2 shows the boundaries of lands and the names of present owners of record of those lands, both surface and subsurface, included in or contiguous to the permit area. BRCW is the owner of all lands within the permit area, as indicated on the legal description provided on the warranty deeds in Appendix 1-1, and therefore has the legal right to enter the property and recover coal from the existing waste rock pile. The permit area consists of approximately 49.05 fee acres. No Federal or State land exists within the permit area. As the owner of the property, BRCW has a legal right to operate on all of the lands within the permit area.

No coal recovery operations will be conducted within 100 feet of a public road. The only activity associated with this plan to be conducted within 100 feet of a public road (State Route 31) will be where the site access road joins that right-of-way.

Mining Sequence and Planned Subsidence. No underground mining will occur at this site. Therefore, no subsidence is anticipated. All land proposed to be affected by operations and reclamation at the waste rock site is shown on Plate 5-1. This Plate also provides an estimate of the total quantity of waste rock at the site that will be processed. It is anticipated that all coal recovery operations will be completed within one year of beginning. Therefore, Plate 5-1 also shows the extent of annual operations associated with this permit application. Reclamation of the site will begin as soon as practical following coal recovery operations. An estimate of the reclamation timetable is provided in Table 5-1. It is not currently anticipated that additional permits will be sought from the Division for this operation. All coal recovery and reclamation operations will occur within the disturbed area boundary shown on Plate 5-1 unless approved otherwise beforehand by the Division.

Land Surface Configuration. The surface contour data presented in Plate 5-1 were developed by an aerial survey conducted on September 26, 2014 by Aero-graphics. The 2-foot contour interval of this map is sufficient to clearly show surface topography and slope within the permit and adjacent areas.

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Surface Facilities. Plate 5-1 shows the locations of the following surface facilities:

- Sedimentation pond,
- Roads, and
- Soil stockpile areas.

It is currently anticipated that coal recovery and loading operations will occur within the footprint of the existing waste rock piles noted on Plate 5-1. No buildings, utility corridors, or similar facilities exist or will be used within the permit area. No coal processing waste banks, dams, or embankments exist in the permit area. Similarly, no spoil or coal preparation waste sites exist in the permit area. The permit area shown on Plate 5-1 is the same as the land area for which a performance bond or other guarantee has been posted.

General refuse that is generated on site will be regularly removed from the site. This waste will consist predominantly of daily miscellaneous garbage (e.g., food wrappers, drink bottles, etc.) that will be responsibility of the individuals that generate the waste. A waste container will be provided for larger items of garbage that may be generated at the site. This waste will be disposed of (before the container is full) at an off-site location that permitted to accept such waste.

Transportation Facilities. Energy West constructed an access road to the waste rock pile at the beginning of site operations. This road, which will be used and maintained by BRCW during coal recovery and reclamation activities, is shown on Plate 5-1. Typical cross sections for the access road are also shown on Plate 5-1. A temporary roadway accessing the top of the waste rock pile is also shown on Plate 5-1. No permanent conveyors do or will exist in the permit area.

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The general location of the site access road was disturbed by activities associated with the Utah Power and Light Research Farm prior to construction of the waste rock site. The access road was upgraded in the late 1980s, following issuance of the waste-rock facility permit, to a typical road width of 24 feet. The road subgrade was prepared by scarifying the ground to a depth of 6

inches and compacting the soil to 90% of standard Proctor density. The road subgrade consists of approximately 10 inches of bottom ash supplied from the Huntington Power Plant. This material was moisture-conditioned and compacted to 95% of standard Proctor density.

The untreated road base consists of 1-inch minus crushed gravel, with approximately 9% fines. The material was moisture conditioned and compacted to 95% of standard Proctor density. The final surface lift of the access road consists of a 3-inch thick layer of compacted, rotomilled asphalt.

The gradient of the access road averages approximately 3.3%, ranging from about 1.7% to 4.2%. The road surface slopes at a grade of about 1% toward roadside drainage channels. Road cut and fill slopes were typically constructed at angles of 1.5H:1V. Cuts into rock were constructed at slopes of approximately 0.5H:1V. A locking gate has been installed on the access road near its intersection with State Route 31 to control access to the site.

The locations of culverts and drainage ditches associated with the permit-area roads are shown on Plate 5-1. These drainage structures are discussed in Section 7.5.2.2 of this application.

5.2.1.2 Signs and Markers

Permit Identification Signs. A permit identification sign will be placed so that it is visible from the location where the site access road joins State Route 31. The sign will be of a design that can be easily seen and read, will be made of durable material, and will conform to local laws and regulations. The sign will contain the following information:

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- The name, business address, and telephone number of the permittee and
- The permanent program permit number as obtained from the Division.

The sign will be retained and maintained until after the release of all bonds for the permit area.

Perimeter Markers. The perimeter of the facility (disturbed area boundary) is marked with a fence.

Buffer Zone Markers. Since the facility is not located near a perennial or intermittent stream channel, there are no stream buffer zone markers at the site.

Topsoil Markers. Markers have been placed on each soil stockpile indicating that they contain topsoil.

5.2.2 Coal Recovery

The operations anticipated under this application will be for the recovery of coal from an existing waste rock pile, thereby converting a waste material into a valuable product. An inspection report filed by Energy West for the fourth quarter of 2014 indicates that the waste rock site has a capacity of 468,215 yd^3. This report further states that the north half of the site is filled to 87% of capacity and the south half is filled to 44% of capacity. Assuming that the capacities of the north and south halves of the site were equal, approximately 306, 700 yd^3 of waste rock exist on the site at the time of this application. Placement of a substantial additional quantity of waste rock at the site is not anticipated by Energy West.

Coal recovery from the Deer Creek waste rock pile will be performed by crushing, screening, and other methods as appropriate. Primary equipment to be used in coal recovery operations will include loaders, excavators, a crusher, and haul trucks. The goal of the recovery operations will be to maximize the economic recovery of coal, thereby minimizing (to the extent economically feasible) the quantity of this valuable resource that remains on site at the time of reclamation. It is anticipated that the operations proposed herein will recover approximately 60% of the existing material from the existing waste rock pile, leaving 40% of the volume as reject to be disposed of on site

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Activities associated with coal recovery will be kept within the footprint of the existing waste rock pile unless approved otherwise beforehand by the Division. Waste rock will initially be excavated from the south side of the pile, with the recovered coal and the waste rock reject temporarily stored on unprocessed waste rock. The control of runoff and sediment will be maintained during this operation as discussed in Section 7.4.6.2. The recovered coal will be transported by truck to the BRCW dry-coal cleaning facility located on in Wellington, Utah for further processing. The reject material will be placed in the area from which the waste rock was excavated once sufficient space becomes available.

It is currently anticipated that all waste rock will be processed through the entire thickness of the pile. Exceptions may occur in areas where the bottom layer of material contains minimal recoverable coal or in areas where a base of coarser material is needed to permit equipment traffic in the area. As more waste rock is processed, temporary storage of recovered coal and final storage of reject will occur in areas currently occupied by waste rock.

Areas outside of the existing waste rock footprint will be disturbed only if it becomes impractical to conduct all operations within the existing footprint. BRCW will not move operations outside of the existing waste rock footprint without first modifying this permit application and obtaining approval for that modification from the Division. If it becomes necessary to move outside of the existing footprint, topsoil and subsoil will be removed from areas of planned disturbance. This soil will be segregated into topsoil and subsoil stockpiles at the edge of the planned disturbance. The soil stockpiles will be surrounded by silt fences, straw wattles, or soil berms to preclude off-pile transport of sediment. If runoff from the future disturbed area will not report to the sedimentation pond, that portion of the disturbed area will also be surrounded by a silt fence, straw wattles, or berms, except for breaks for vehicle access. The ground at any such breaks will be graded to prevent off-site transport of sediment.

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5.2.3 Mining Methods

No underground or surface mining of naturally in-place coal will occur at the Deer Creek site. However, coal will be recovered from the existing waste rock pile using the methods discussed in Section 5.2.2. It is anticipated that coal recovery operations at the site will be completed within one 12-month period. Hence, assuming recovery of 184,020 cubic yards of coal (60% of the total volume of 306,700 cubic yards of waste rock, as indicated above), the annual and total production of coal from the site will be approximately 129,200 tons (based on a unit weight of 52 pounds per cubic foot for broken coal).

5.2.4 Blasting and Explosives

Blasting and explosives will not be stored or used at the site.

5.2.5 Subsidence

There will be no underground mining or subsidence at this facility. Hence, no pre-subsidence survey will be conducted, no areas require protection from subsidence, no subsidence control plan will be developed, no subsidence control measures will be implemented, no subsidence damage repair will be performed, and no public notice of underground mining activities will be required.

5.2.6 Mine Facilities

Although no underground or surface coal mining will occur at the Deer Creek site, mobile equipment will be used to recover coal from the waste rock pile. The equipment and associated processes that are planned for use at the site are detailed in the following sections.

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5.2.6.1 Mine Structures and Facilities

Waste rock has been placed at the Deer Creek site since the late 1980s. No permanent structures (e.g., buildings, utilities, processing equipment, etc.) were present at the site prior to the submittal of this application. No permanent structures will be installed as part of the operations planned herein. Crushing and screening equipment will be temporarily located on site to process the waste rock and recover coal. Loaders and other mobile equipment will be used as needed to move material from the waste rock pile to the processing area and from the processing area to the transport trucks. No footings or other foundations will be constructed for this equipment. All equipment will be actively maintained in good functional condition.

It is anticipated that the crushing and screening equipment will be mobilized to the site as soon as feasible after issuance of regulatory permits. This equipment will be operated in accordance with manufacturer's recommendations and permits issued by the Utah Division of Oil, Gas and Mining and the Utah Division of Air Quality. All of the equipment will be used specifically to recover coal from the waste rock and is considered adequate to meet the requirements of R645-301. No coal recovery operations will occur within 100 feet of the right-of-way of any public road, except for the transport of coal from the site where the access road joins that right-of-way. No public roads will be relocated under the operations planned herein. All crushing, screening, and other equipment required for this operation will be removed following operations in accordance with the reclamation plan discussed in Section 5.40.

5.2.6.2 Utility Installation and Support Facilities

Utility Installations. No electric lines, telephone transmission lines, water lines, sewer lines, water wells, oil wells, or other utilities currently pass over, under, or through the permit area. Operations at the site will use temporary utilities only (i.e., generators, water transported to the site via tankers, etc.). All operations will be conducted to prevent damage, destruction, or disruption of

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utility services in the general area. Since there is no planned subsidence on site, no utilities are located within permit area subsidence zones.

Support Facilities. Support facilities at the Deer Creek site will consist only of mobile equipment. No permanent equipment or utilities will be constructed at the site. All equipment will be operated in accordance with the permit issued for this operation. Support facilities will be located, maintained, and used in a manner that:

- Prevents or controls erosion and siltation, water pollution, and damage to public or private property,
- To the extent possible, using the best technology currently available, minimizes damage to fish, wildlife, and related environmental values, and
- Minimizes additional contributions of suspended solids to stream flow or runoff outside the permit area.

All support facilities will be removed following operations in accordance with the reclamation plan discussed in Section 5.40.

Water Pollution Control Facilities. Water pollution control facilities at the Deer Creek site consist of one sedimentation pond (with its appurtenant structures), silt fences, and straw wattles. Sanitary waste at the site will be handled via portable toilets. The sedimentation pond will be reclaimed and the portable toilet will be removed following the completion of coal recovery operations at the site. Site reclamation is discussed in Section 5.40.

The sedimentation pond and appurtenant structures have been constructed as discussed in Chapter 7 and will be used and maintained as discussed in Section 5.3.3.7 of this application.

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5.2.7 Transportation Facilities

5.2.7.1 Road Classification

The access road that leads to the facility from State Route 31 will be used to transport coal and is classified as a primary road. Interior roads at the site are considered ancillary.

5.2.7.2 Description of Transportation Facilities

No surface conveyors (other than those that may be used to transfer and temporarily stockpile materials for or after processing) or rail systems have been or will be constructed, used, or maintained within the permit area.

Road Specifications. Cross sections are provided on Plate 5-1 for the access road that will be used and maintained by BRCW. Information regarding road drainage is presented in Chapter 7. Additional information regarding the site access road is provided in Section 5.2.1.1.

The access road will be maintained and repaired as needed prior to reclamation. Maintenance work will be performed to ensure that the road and the associated drainage structures (ditches and culverts) meet the design standards and to ensure the safety and proper functioning of trucks and equipment. Road maintenance may include repairs to potholes and other defects that affect the normal operability of the road. Drainage system maintenance may include cleaning of ditches and culverts as needed to maintain design capacities. Roads within the permit area that are damaged by a catastrophic event, such as a flood or earthquake, will be repaired as soon as practical after the damage has occurred.

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Drainageway Alterations. No alterations or relocations of natural drainageways are required within the permit area to accommodate the needs of transportation systems.

5.2.8 Handling and Disposal of Coal, Excess Spoil, and Coal Mine Waste

5.2.8.1 Coal Handling and Transportation

Coal will be recovered from the waste rock pile using crushing and screening equipment and other equipment as needed to maximize coal recovery within economic constraints. Additional information regarding planned coal recovery operations at the site is provided in Section 5.2.6 of this application. Crushing and screening operations will be conducted within the footprint of the existing waste rock pile using a mobile crusher. The crusher will be moved within the pile footprint as needed to maintain efficient operations. Recovered coal will be temporarily stored adjacent to the crusher location, within the footprint of the existing waste rock pile, until this coal is loaded and hauled off site. The recovered coal will be transported by truck to the BRCW dry-coal cleaning facility for further processing.

5.2.8.2 Overburden

No overburden will be removed, handled, stored, or transported within the permit area.

5.2.8.3 Spoil, Coal Processing Waste, Non-Coal Waste, and Mine Development Waste

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Excess Spoil. No spoil will be generated at the Deer Creek site.

Coal Processing Waste. Following recovery of coal from the waste rock, all reject material will be placed back on areas currently occupied by the waste rock. It is anticipated that the operations proposed herein will recover approximately 60% of the existing material, leaving 40% of the volume as reject to be returned to the waste rock pile. With a current volume of approximately 306,700 yd^3 in the waste rock pile (see Section 5.2.2), it is anticipated that about 184,000 yd^3 of material will be removed from the site, leaving 127,700 yd^3 of reject for on-site

disposal. Under the reclamation plan presented herein, the footprint of the reject pile will cover approximately the same area as the current waste rock pile, thereby reducing the height of the pile below that which currently exists. Additional information regarding placement, compaction, and final reclamation of the reject is provided in Sections 5.3.6 and 5.4.2.2.

Non-Coal Mine Waste. No non-coal waste will be disposed of within the permit area. No non-coal waste that is defined as hazardous in 40 CFR 261 will be generated at the site. If such waste is generated in the future, it will be handled in accordance with the requirements of Subtitle C of the Resource Conservation and Recovery Act and any implementing regulation.

Underground Development Waste. No new underground development waste will be generated at the site. Reject from the recovery operations will be placed back within the footprint of the existing waste rock pile, as described above. Additional information regarding the placement of this refuse is provided in Section 5.3.6 of this application.

Minimization of Acid, Toxic, and Fire Hazards. Data presented in Section 6.2.3 and Appendix 6-1 of this application indicate that the waste rock from which coal will be recovered is neither acid- nor toxic-forming. Thus, no acid- or toxic-forming materials will be placed on the site following recovery of coal from the existing waste rock.

Coal that is recovered from the waste rock pile will be only temporarily stored at the site. Hence, there is no significant potential for this coal to spontaneously combust. Any coal fires that do occur will be handled as outlined in Section 5.1.3.8. No waste materials that constitute a fire hazard (i.e. grease, lubricants, paints, and flammable liquids) will be accumulated at the site.

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5.2.8.4 Dams, Embankments, and Impoundments

No dams, embankments, or impoundments will be used for the handling or disposal of coal, overburden, excess spoil, or coal mine waste in the permit area.

5.2.9 Management of Mine Openings

There are no mine openings at the Deer Creek site.

5.30 Operational Design Criteria and Plans

5.3.1 General

This application contains a general plan for the sedimentation pond located in the permit area. No other water impoundments or coal processing waste banks, dams, or embankments exist in the permit area. Since subsidence will not occur at the site, and no underground mining has occurred beneath the site, no damage will occur to surface operations due to subsidence.

5.3.2 Sediment Control

Sediment-control measures for the Deer Creek site are described in Section 7.3.2 of this application. Sediment-control structures at the site consist of a sedimentation pond located adjacent to the west side of the waste rock pile, silt fences and straw wattles installed in areas that do not flow to the sedimentation pond, and drainage ditches and culverts that convey disturbed-area runoff to the sedimentation pond and undisturbed-area runoff away from disturbed areas. Runoff-control structures have been designed to convey runoff in a non-erosive manner.

Runoff is retained behind the silt fences and straw wattles that have been installed in areas that do not flow to the sedimentation pond, thereby precluding discharge of this water to undisturbed areas. Additional information regarding sediment-control measures at the site is provided in Section 7.3.2.

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In addition to the use of a sedimentation pond, silt fences, straw wattles, and properly designed runoff-control facilities, sediment yields in the permit area will be further minimized by:

- Disturbing the smallest practicable area during operations,
- Contemporaneously reclaiming areas suitable for such reclamation,
- Roughening of the surface soil during topsoil redistribution, and
- Construction of a stable site entrance (Figure 5-2) at the northern extent of the asphalt roadway, thereby minimizing the potential for off-site transport of sediment via vehicle tires.

5.3.3 Impoundments

5.3.3.1 Slope Stability

The sedimentation pond located immediately west of the waste rock pile was constructed by excavating approximately 6 feet of soil, thereby creating a below-grade impoundment. The resulting depression has the required storage capacity with the design elevation of water primarily below the natural grade line. Appendix 5-3 contains a stability analysis of the pond embankment. According to these analyses, the minimum calculated factors of safety for the outslope and inslope of the pond are 2.89 and 2.02, respectively. These values exceed the minimum safety factor of 1.3 required for pond embankment by R645-301-533.100.

5.3.3.2 Foundation Considerations

The sedimentation pond was constructed below grade in stable, natural soil. Cross sections of the sedimentation pond are presented in Chapter 7 of this document.

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5.3.3.3 Slope Protection

The outslopes and inslopes of the sedimentation pond are periodically inspected for signs of surface erosion. The inlets and outlets of the pond are armored with rip rap.

5.3.3.4 Embankment Faces

The soil stockpiles that surround the sedimentation pond have been revegetated to protect against erosion. Riprap has also been placed to protect pond slopes and embankments near the discharge structures.

5.3.3.5 Highwalls

No highwalls are located within the permitted boundary.

5.3.3.6 MSHA Criteria

The site sedimentation pond does not meet the size criteria of 30 CFR 216(a).

5.3.3.7 Pond Operation and Maintenance Plans

The sedimentation pond was designed in accordance with R645-301-740. Details of this design are presented in Chapter 7.

The sedimentation pond is designed as a total containment structure, with an emergency spillway to discharge water in the event that a storm generates sufficient runoff to exceed the design capacity. Since the pond was designed to contain the runoff resulting from two 100-year, 24-hour storm events, the probability of exceeding the storage capacity of the pond is extremely

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small. Water held in the pond evaporates or infiltrates into the ground. Water may also be pumped from the pond for use in dust suppression at the site.

Inspections of the sedimentation pond will be conducted on a quarterly basis (see Section 5.1.4.3). Maintenance that is required to keep the pond in good working condition will be performed on an as-needed basis.

Sediment will be removed from the pond when it accumulates to 60 percent of the design sediment storage volume. If coal collects in the pond, this coal will be recovered as part of normal site operations. Non-coal sediment will be placed with the reject from the coal recovery operations.

5.3.4 Roads

5.3.4.1 Location, Design, Construction, Reconstruction, Use, Maintenance, and Reclamation

Control of Damage to Public or Private Property. All roads used by BRCW were designed in accordance with applicable County and facility-use requirements. By designing according to these standards, the potential for damage to public or private property has been minimized.

Road Surfacing. The site access road is surfaced with rotomilled asphalt that was compacted during placement (see Section 5.2.1.1. No acid- or toxic-forming materials have been or will be used in the road surfaces.

Slope Stability. The site access road was constructed in the late 1980s and has been used for site operations for over 25 years. No road slope stability issues have been observed during this time frame. An analysis of the stability of the road embankment is provided in Appendix 5-3. As

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indicated therein, the minimum calculated safety factor against failure of the road embankment is 1.46 under both existing and reclaimed scenarios. This exceeds the minimum safety factor of 1.3 required for roads by R645-301-534.130.

5.3.4.2 Environmental Protection and Safety

Safety and environmental protection were primary concerns during the design and construction of the access road. The grade, width, and surface materials used for the road was selected to be appropriate for the planned duration and use of the road.

5.3.4.3 Primary Roads

The site access road was designed, constructed, and will be maintained to meet the requirements of Utah Administrative Rules R645-301-358, R645-301-527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-542.600, R645-301-542.600, and R645-301-762. Furthermore, the road has the following characteristics:

- It is located on a stable surface,
- It was constructed with a sufficiently durable surface for the traffic volume and vehicle speeds on the road,
- It is maintained as needed, and
- Culverts have been designed, constructed, and are maintained to withstand the loads imparted by the vehicle traffic on the road.

5.3.5 Spoil

No spoil is generated in the permit area.

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5.3.6 Coal Mine Waste

Coal will be recovered from the existing waste rock pile to the extent feasible. Material that is not economically recoverable ("reject") will be placed in a controlled manner back within the footprint of the existing waste rock pile. Information regarding placement of the reject material is provided below.

5.3.6.1 Design

A geotechnical evaluation of the waste rock and the foundation beneath the pile was conducted in 1988 prior to construction of the pile. The results of this evaluation are provided in Appendix 5-2. As part of that investigation, two holes were drilled in the vicinity of the waste rock pile, one to a depth of 80 feet and the other to a depth of 82 feet. These holes encountered low plasticity clay to sandy-gravelly clay (i.e., weathered shale) to a depth of 15 to 16 feet at the site. This material was described as cohesive and in a medium-stiff condition. The in-place density of the soil was 108 to 117 lb/ft^3. The unweathered shale at depth was defined as competent. Thus, the foundation upon which the waste rock rests is considered stable.

Stability analyses presented in Appendix 5-2 indicate that the minimum static safety factor against mass failure of the pile is 1.50 for a pile outslope of 1.75H:1V and 1.62 for a pile outslope of 2H:1V. These safety factors were calculated assuming conservative values for soil strength, based on the results of field and laboratory analyses of soils at the site, as outlined in Appendix 5-2. These safety factors meet or exceed the minimum requirements of R645-536.110.

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5.3.6.2 Waste Emplacement

Reject from coal recovery operations will be placed with outslopes of approximately 2H:1V, thereby enhancing the stability of the waste pile. The reject will be placed in horizontal lifts that do not exceed 2 feet in thickness. The geotechnical evaluation provided in Appendix 5-2

indicates that placement of the reject in this manner will be structurally stable, with a minimum factor of safety against failure of 1.5 if the ground immediately below the reject is saturated and a higher safety factor if the underlying ground is not saturated (as is expected). The material will be dumped from loaders or haul trucks. Loaders or dozers will be used to rework and initially compact the dumped material. Additional compaction of each lift will be accomplished by routing the loaded equipment over the prior lift surface.

5.3.6.3 Excess Spoil Fills

No excess spoil fills exist in the permit area.

5.3.6.4 Impounding Structures Constructed of Coal Mine Waste

No impounding structures have been or will be constructed of coal mine waste in the permit area.

5.3.6.5 Disposal of Coal Mine Waste in Special Areas

No coal mine waste has been or will be disposed of in special areas in the permit area.

5.3.6.6 Underground Development Waste

A description of pre-disturbance soil resources at the waste-rock disposal site is provided in Chapter 2 of this application. Methods used to stockpile topsoil at the site are also discussed in Chapter 2.

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As indicated in Section 6.2.3 of this application, the material in the waste rock pile is neither acid- nor toxic-forming. Furthermore, as discussed in Sections 5.3.6.1 and 5.3.6.2 above,

the reject pile will be stable following placement. Therefore, reject material is considered suitable for reclamation.

5.3.6.7 Coal Processing Waste

No coal processing waste generated within the permit area will be returned to abandoned underground workings.

5.3.6.8 Coal Processing Waste Banks, Dams, and Embankments

No coal processing waste banks, dams, or embankments exist within the permit area.

5.3.6.9 Refuse Piles

A description of the anticipated reject pile is provided elsewhere in this application. Specifically:

- A description of the pre-disturbance soils is provided in Chapter 2.
- A discussion of the suitability of the reject for reclamation is provided in Section 5.3.6.6.
- Certification of all designs and plans is provided in the chapters where those designs and plans are first presented.
- A description of proposed inspection activities is provided in Section 5.1.4.2.
- A description of the design, stability, operation, and reclamation of the final reject disposal site is provided in various subparts of Section 5.3.6.
- A discussion of runoff- and sediment-control plans associated with the site is provided in Chapter 7.

All designs and plans presented in this application were prepared in compliance with applicable MSHA regulations.

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5.3.7 Regraded Slopes

Reclamation of this site will not involve significant regrading of slopes.

5.40 Reclamation Plan

5.4.1 General

Prior to disturbance of the area by Energy West for use as a waste rock disposal facility, land within the permit area was used as wildlife habitat. BRCW intends to reclaim the site in a manner that returns the site to a condition that will serve as wildlife habitat. This is consistent with the pre-mining land use and also the capability of the soil as defined in Section 2.2.2.4 of this application (Class 8 capability, indicating that the soil cannot support agricultural and other high-use activities but can support recreational uses, wildlife habitat, watershed, or esthetic uses). A post-mining land use of wildlife habitat is also consistent with current zoning ordinances (see Scction 4.1.1.1 of this application).

5.4.1.1 Commitment

Upon the permanent cessation of coal recovery operations at the Deer Creek site, BRCW will reclaim the site so that it is compatible with use for wildlife habitat. Stockpiled soil will be redistributed over the disturbed area and this area will be revegetated using the approved seed mix.

5.4.1.2 Surface Coal Mining and Reclamation Activities

No underground openings, equipment, structures, or other facilities exist in the permit area.

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5.4.1.3 Underground Coal Mining and Reclamation Activities

No surface equipment, structures, or other facilities exist in the permit area.

5.4.1.4 Environmental Protection Performance Standards

The plan presented herein is designed to meet the requirements of R645-301 and the environmental protection performance standards of the State Program.

5.4.2 Narratives, Maps, and Plans

5.4.2.1 Reclamation Timetable

A timetable for the completion of each major step in the reclamation plan is presented in Table 5-1. Although significant precedence has been set in Utah for the reclamation of mine sites using a method known as deep gouging, BRCW will retain the sedimentation pond during initial site reclamation and implement reclamation of the Deer Creek site in a phased manner to satisfy the requirements of R645-31-763.100. This phasing is shown on Plate 5-3. It is anticipated that reclamation of the site will proceed in the following general order:

1. Install temporary sediment controls (silt fences, straw wattles, etc.) in areas not otherwise controlled.
2. Grade the reject pile to achieve the final configuration within the Phase I area noted on Plate 5-3.
3. Construct temporary berms and diversion channels as needed along the edges of the regraded reject pile to convey runoff from the reject pile to the sedimentation pond.
4. Remove the upper foot of soil from the soil stockpiles adjacent to the reject pile and temporarily segregate this for use as topsoil. Initially maintain the soil stockpiles that form the embankments for the sedimentation pond for later reclamation use.
5. Place subsoil from the soil stockpiles onto the regraded reject pile.
6. Place topsoil on the subsoil that has been placed on the regraded reject pile.
7. Incorporate mulch and gouge the topsoil.
8. Revegetate the topsoil that was placed on the regraded reject pile.

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9. Wait for 2 years to satisfy the requirements of R645-301-763.100.
10. Remove asphalt from the site access road and place this asphalt within the sedimentation pond.
11. Construct final reclamation channels RC-1 through RC-6 and regrade the surface of the reclaimed reject pile where disturbed by Phase II reclamation.
12. Regrade the areas of the current undisturbed-area diversions as needed to allow free drainage of off-site areas through the reclamation channels.
13. Place the material excavated for construction of the final reclamation channels in the area of the sedimentation pond and grade this material as needed.
14. Segregate the remaining topsoil from the berm of the sedimentation pond. Place the subsoil and topsoil from this berm on the reject exposed during construction of the reclamation channels and on the graded reject within the current boundaries of the sedimentation pond.
15. Incorporate mulch and gouge the topsoil.
16. Revegetate the topsoil that was placed during Phase II as well as previously revegetated areas that were disturbed during construction of the reclamation channels and Phase II grading activities.
17. Recontour the access road, construct the associated reclamation channels, and revegetate the area of the access road. This work will proceed from north to south in a manner that allows the efficient use of equipment.

BRCW acknowledges that the Utah Coal Regulatory Program calls for sedimentation ponds to be retained for a period of at least 2 years after the last augmented seeding following the initiation of reclamation activities (see R645-301-356.300 and R645-301-763). Although, as indicated in Figure 5-3, this rule would prevent final reclamation and/or cause re-disturbance of at least 6.01 acres of the 14.69-acre total disturbed area following the waiting period after the last augmented seeding, BRCW will reclaim the site in a phased approach as indicated above to comply with the rule.

The proven surface-roughening technique known as deep gouging retains essentially all of the precipitation that falls on a site, as indicated in Appendix 5-4. Nonetheless, temporary diversion ditches will be installed at the locations shown on Plate 5-3 to provide an extra measure of assurance that runoff from the disturbed area will report to the sedimentation pond during the period between Phase I and Phase II reclamation. The design of these temporary diversions is

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discussed in Chapter 7. The temporary sediment controls installed at the beginning of Phase I reclamation will be retained to control sediment yield from areas not otherwise controlled.

5.4.2.2 Plan for Backfilling, Soil Stabilization, Compacting, and Grading

Prior to beginning reclamation operations, erosion and sediment yield from all areas to be affected by these operations will be controlled by installation of silt fences, straw wattles, or soil berms, except for breaks for vehicle access. The ground at any such breaks will be graded to prevent off-site transport of sediment.

The reject pile will be regraded to slope generally from east to west and north to south, as shown on Plate 5-3. This will be accomplished using dozers, loaders, trackhoes, and/or other equipment as needed. The material will be compacted using a sheepsfoot roller or other appropriate equipment to achieve approximately 90% of standard Proctor density.

A cap consisting of subsoil overlain by topsoil will be placed on the surface of the regraded reject pile. It is currently anticipated that topsoil will be removed first from the upper 12 inches of the north soil stockpile, to approximately the northwest edge of the Phase I reclamation area, and placed in a temporary stockpile located in an area of convenient access. The subsoil from that portion of the north stockpile will then be spread in 12-inch (maximum) uncompacted lifts over the northern portion of the regraded reject pile. Spreading of the soil will be accomplished using loaders, dozers, trackhoes, and/or other equipment as needed. This subsoil will be compacted to achieve approximately 90% of standard Proctor density. The upper layer of the redistributed subsoil will be minimally compacted and scarified to promote bonding with topsoil. The topsoil material from the temporary stockpile will then be distributed over the redistributed subsoil layer. The topsoil will be spread using track-mounted equipment to minimize compaction so as not to interfere with plant root development.

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Reclamation of the western and southern portions of the regraded reject pile will occur as outlined above. Topsoil will be removed from the upper 12 inches of the adjacent soil stockpiles, to approximately the southwest corner of the Phase I reclamation area, and temporarily stored in an area of convenient access. Subsoil will then be spread over the remainder of the regraded area, leaving the top layer of subsoil in a less-compacted state. The topsoil will then be placed on the reclaimed surface.

Mulch will be applied to the redistributed topsoil at the rates identified in Section 2.4.4.2 of this application. Following application of the mulch, the mulch will be crimped into the topsoil and the soil surface will be gouged to promote moisture retention and minimize erosion. Surface gouging will be accomplished using a trackhoe bucket or dozer blade to create small depressions throughout the soil surface. The reclaimed area will then be seeded as indicated in Section 3.4.1.2 of this application.

In accordance with R645301-763.100, two years following the completion of Phase I reclamation operations, the asphalt surface will be scraped from the site access road and placed within the basin of the sedimentation pond. This will be accomplished using dozers, loaders, haul trucks, and/or other equipment as needed. The road surface will be graded and watered as needed following removal of the asphalt to allow efficient access to the site and to suppress dust during reclamation operations.

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Reclamation channels will then be cut through the previously-reclaimed reject pile into the underlying soil (see Plate 5-3). These channels will be lined with riprap and have the dimensions described in Section 7.6.1 and Appendix 7-9 of this application. Materials removed during excavation of the reclamation channels will be placed within the basin of the sedimentation pond and compacted as outlined above. The Phase I reclamation channels will also be removed using trackhoes and dozers as appropriate. Topsoil will then be stripped from the upper 12 inches of the sedimentation pond berms and set aside. The subsoil that comprises the remainder of the sedimentation pond berms will then be pushed onto the material that was

placed in the pond basin, as outlined above. Subsoil will also be placed on the reject that was exposed during excavation of the reclamation channels and removal of the Phase I reclamation channels. The segregated topsoil will then be placed on the subsoil and the topsoil will be mulched. All areas that were disturbed during Phase II reclamation of the reject pile will then be seeded as indicated above.

Information presented on Plate 2-1 indicates that the soil stockpiles adjacent to the current waste rock pile contain 33,898 yd^3 of subsoil and 2,303 yd^3 of topsoil. This is sufficient to place an average of approximately 35 inches of subsoil over the area of the former waste rock pile and sedimentation pond (to be occupied at that time by the reject pile), and 2.5 inches of topsoil over the reclaimed area. This thickness of cover over the reject is considered sufficient, given that the reject is neither acid- nor toxic-forming (see Section 6.2.3 of this application).

Final reclamation of the site access road will occur after the remainder of the site has been reclaimed (i.e., after access to the site by heavy equipment is no longer needed). The gravel road surface material and bottom ash road subgrade material will be graded against the inside cut slopes of the road cross-section. The topsoil on the embankment outslopes will be removed and temporarily stockpiled where it will not be damaged by subsequent reclamation efforts. The subsoil material from the embankment slopes will be spread over the redistributed road base. The topsoil material from the temporary stockpiles will then be spread over the area, mulched, gouged, and seeded as outlined above. This will be accomplished in phases as needed to allow equipment access to areas along the road requiring mulching and seeding.

5.4.2.3 Final Surface Configuration Maps and Cross Sections

The anticipated final surface configuration and associated cross sections are shown on Plate 5-3. This Plate also shows the approximate location of the dividing line used to determine reclamation cut and fill volumes in the area of the reject pile and along the site access road. These

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volumes were then used for the sake of determining reclamation costs. Reclamation cross sections are shown on Plates 5-4 and 5-5. No structures will remain on the site following reclamation.

5.4.2.4 Removal of Temporary Structures

All equipment required for coal recovery operations will be removed from the site prior to reclamation.

5.4.2.5 Removal of Sedimentation Ponds

The sedimentation pond will be backfilled during Phase II reclamation. Surface roughening during final reclamation will create a condition that minimizes the potential for erosion of reclaimed areas, thereby precluding off-site impacts following removal of the sedimentation pond (see Appendix 5-4).

5.4.2.6 Roads

All roads within the permit area will be removed during reclamation of the site.

5.4.2.7 Final Abandonment of Mine Openings and Disposal Areas

There are no mine openings, areas of excess spoil, or areas for disposal of non-coal waste in the permit area. The reject from coal recovery operations will be reclaimed as described in Section 5.4.2.2 above.

5.4.2.8 Estimated Cost of Reclamation

The estimated cost to reclaim the Deer Creek site is provided in Chapter 8. Estimated quantities of materials involved in reclamation are also provided in Chapter 8.

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5.50 Reclamation Design Criteria and Plans

5.5.1 Casing and Sealing of Underground Openings

There are no underground openings within the permit area.

5.5.2 Permanent Features

5.5.2.1 Small Depressions

As indicated in Section 5.4.2.2, several small depressions (i.e., gouges) will be left in the reclaimed soil to retain moisture, minimize erosion, and enhance revegetation. This, in turn, will improve wildlife habitat following reclamation.

5.5.2.2 Permanent Impoundments

No impoundments will be permanently retained on the site following reclamation.

5.5.3 Backfilling and Grading

Plans for backfilling and grading of the site upon reclamation have been presented in Section 5.4.2.2 above. This plan was designed to comply with the applicable requirements of R645-301-500 and R645-301-700. As indicated in Section 5.4.2.2, backfilling and grading operations will be conducted in a controlled manner.

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5.5.3.1 Disturbed Area Backfilling and Grading

Approximate Original Contour. As indicated in Section 5.1.2.2 of this plan, non-coal rock and unrecoverable coal will remain at the site. However, due to the nature of such sites, no variance is being requested from the Approximate Original Contour requirements of the regulations.

Elimination of Highwalls, Spoil Piles, and Depressions. No highwalls or spoil piles exist at the site. The sedimentation pond will be removed during site reclamation. Cut slopes along the access road will be backfilled to extent feasible.

Slope Stability. Reject from coal recovery operations will be placed at a slope that provides a minimum static safety factor of 1.62 (see Section 5.3.6.1 of this plan). Cut slopes on the site access road will be backfilled during reclamation at a slope no steeper than the angle of repose of the backfill material.

Erosion and Water Pollution. As indicated in Section 5.4.2.2, the reclaimed soil surface will be left in a roughened state. This will improve moisture retention, promote revegetation, and minimize erosion potential, thereby minimizing water pollution both on and off the site.

Post-Mining Land Use. The disturbed area will be reclaimed in a manner that supports the post-mining wildlife-habitat land use.

5.5.3.2 Spoil and Waste

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Spoil. No spoil is generated within the permit area.

Refuse Piles. As indicated in Section 5.3.6.2 of this application, reject from coal recovery operations will be compacted as it is placed. As further indicated in that section, the reject will be

placed at a slope that provides an adequate static safety factor. Hence, the pile will be stable following reclamation.

Coal Processing Waste. No coal processing waste exists within the permit area.

5.5.3.3 Exposed Coal Seams, Acid- and Toxic-Forming Materials, and Combustible Materials

Exposed Coal Seams. No coal seams will be exposed as part of this operation.

Acid- and Toxic-Forming Materials. No acid-forming materials exist at the site.

Combustible Materials. No combustible materials will be exposed or permanently stored at the site as part of coal recovery operations.

5.5.3.4 Cut-and-Fill Terraces

Cut and fill sections that currently exist along the access road will be regraded during reclamation.

5.5.3.5 Highwalls From Previously Mined Areas

No highwalls from previously mined areas exist within the permit area.

5.5.3.6 Previously Mined Areas Special Compliance Measures

No previously mined areas exist within the permit area.

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5.5.3.7 Backfilling and Grading - Thin Overburden

No surface coal mining and reclamation activities involving thin overburden occur within the permit area.

5.5.3.8 Backfilling and Grading - Thick Overburden

No surface coal mining and reclamation activities involving thick overburden occur within the permit area.

5.5.3.9 Regrading of Settled and Revegetated Fills

No regrading of settled and revegetated fills is anticipated in the permit area.

5.60 Performance Standards

Coal mining and reclamation operations at the Deer Creek site will be conducted in accordance with the approved permit and the requirements of R645-301-510 through R645-301-553.

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TABLE 5-1

Reclamation Timetable

Activity	Approximate Time
Install temporary sediment controls	1 week
Grade reject pile to interim final configuration	2 weeks
Construct diversion channels as needed to direct runoff from the reject pile to the sedimentation pond	1 week
Segregate topsoil and place subsoil and topsoil on the reject pile	2 weeks
Mulch and revegetate reject pile and complete Phase I reclamation	1 week
Wait for 2 years in order to satisfy the requirements of R645-301-763.100	2 years
Remove asphalt from the site access road and place this material within the sedimentation pond	1 week
Construct final reclamation channels across the reject pile and place this material in the area of the sedimentation pond, grading as needed to achieve final configuration and to construct final reclamation channels. Regrade undisturbed-area diversions.	2 weeks
Segregate the remaining topsoil and place subsoil and topsoil from the berm of the sedimentation pond on the area of the backfilled sedimentation pond	1 week
Mulch and revegetate the area of the backfilled sedimentation pond and areas re-affected by construction of final reclamation channels across the reject pile	1 week
Recontour access road, construct associated reclamation channels, and revegetate access road	2 weeks
APPROXIMATE TOTAL TIME	14 weeks + 2 years

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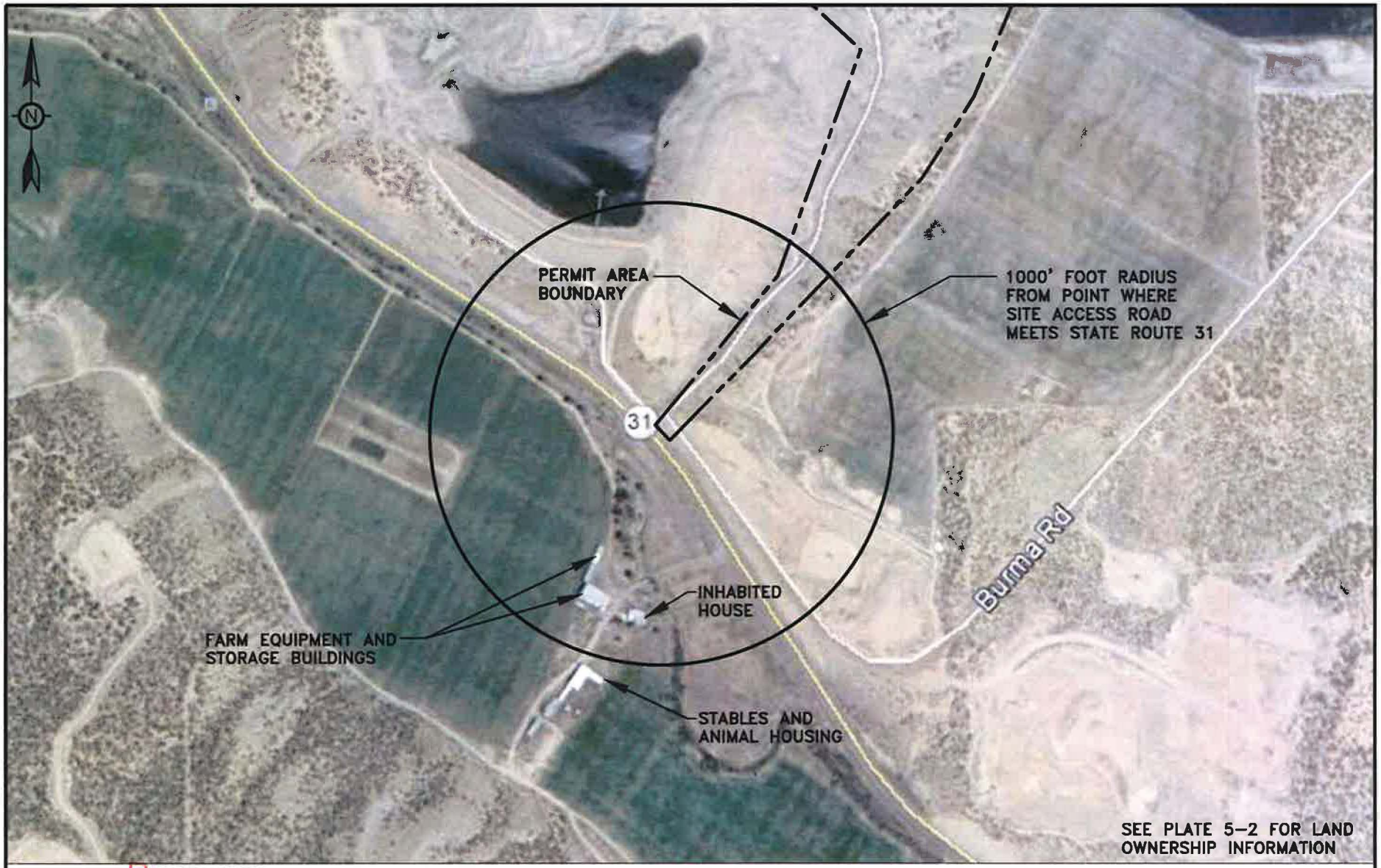

BASE PHOTO: GOOGLE EARTH IMAGE DATED 5/31/2013

0' 600'

FIGURE 5-1. BUILDINGS WITHIN 1000 FEET OF PERMIT AREA.

EarthFax

G:\UC1461\05 - Deer Creek waste rock\Draft MRP\DWG\FIGURE 5-1.dwg, 2/3/2016 11:10:52 AM

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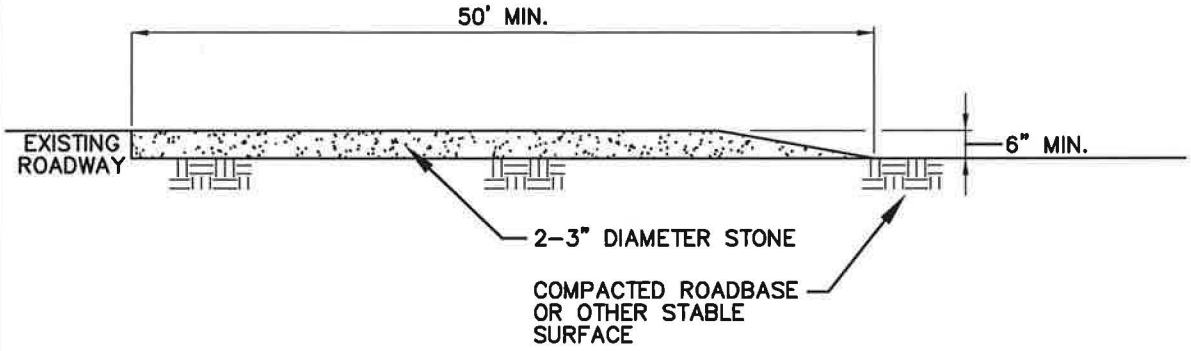
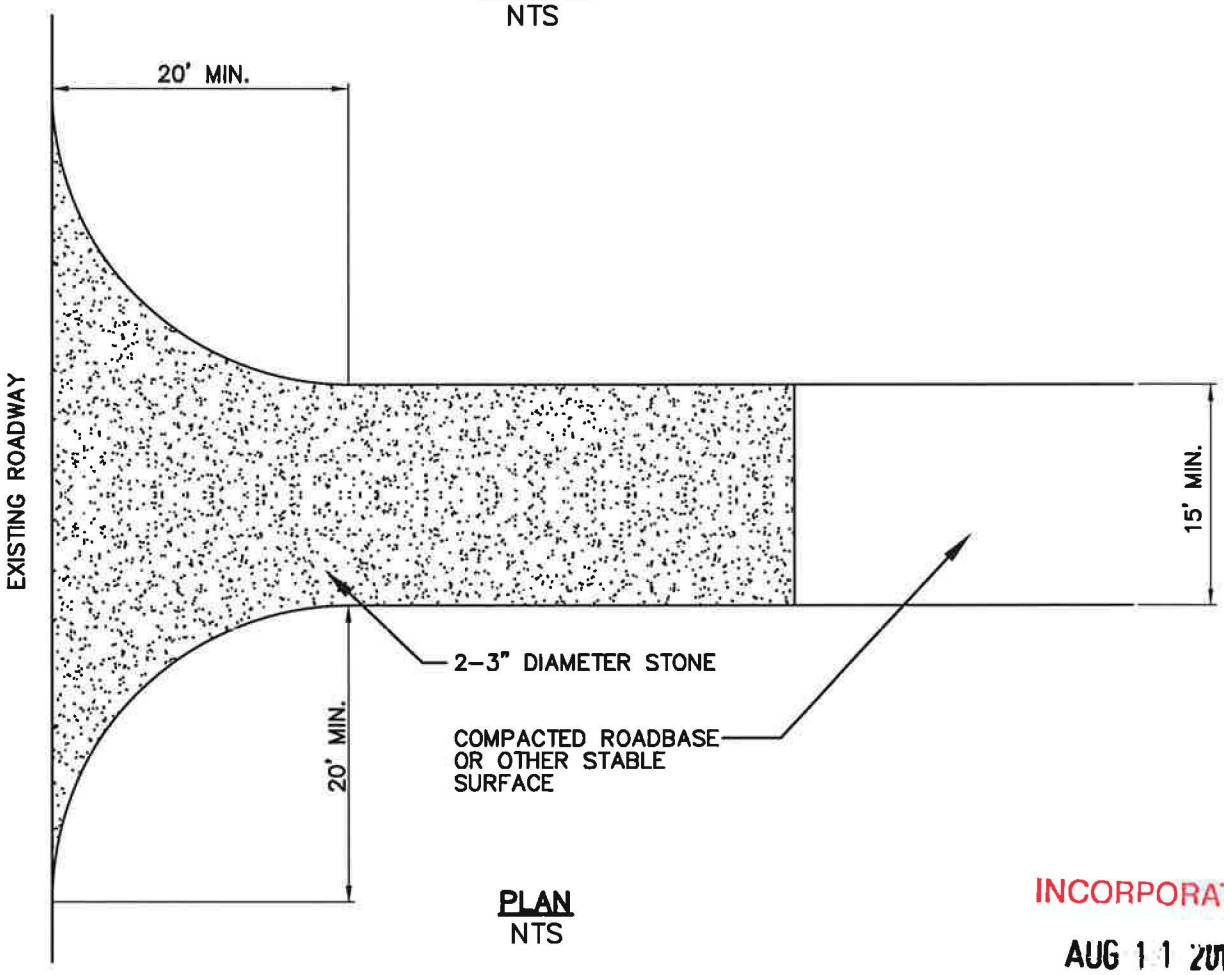


PROFILE
NTS



PLAN
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FIGURE 5–2. STABLE SITE ENTRANCE

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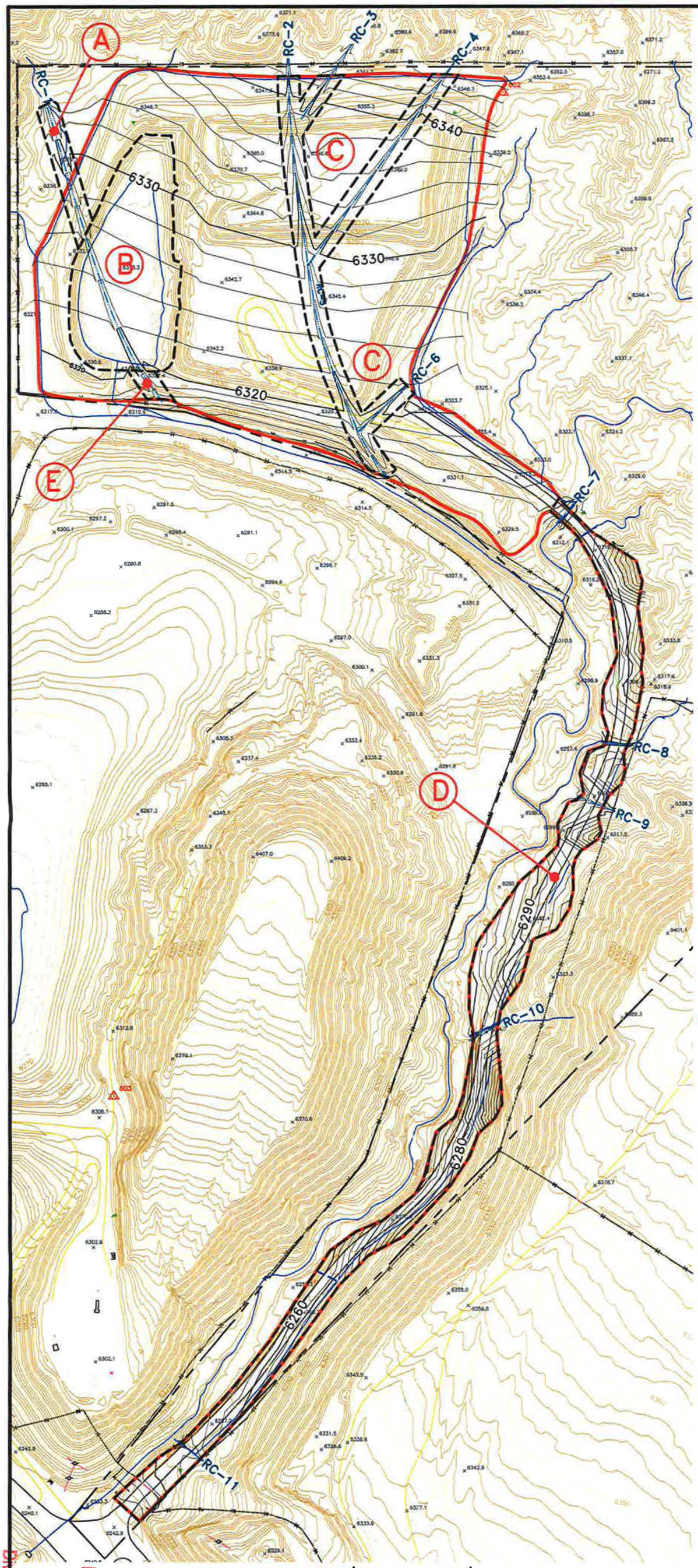
G:\UC1461\05 - Deer Creek waste rock\Draft MRP\DWG\FIGURE 5-2.dwg, 2/4/2016 9:42:51 AM

AREA	ACREAGE	% OF TOTAL DISTURBED AREA
(A)	0.23	1.6
(B)	1.56	10.6
(C)	1.25	8.5
(D)	2.91	19.8
(E)	0.06	0.4
TOTAL	6.01	40.9



LEGEND

DISTURBED AREA BOUNDARY

INITIALLY UNRECLAIMABLE IF SEDIMENTATION POND IS RETAINED

FIGURE 5-3. MINIMUM SITE AREA AFFECTED BY RULE REQUIRING RETENTION OF SEDIMENTATION POND DURING RECLAMATION

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G:\UC1461\05 - Deer Creek waste rock\Draft MRP\DWG\FIGURE 5-3.dwg, 2/3/2016 11:52:16 AM

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APPENDIX 5-1

Road Certification

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EarthFax Engineering Group, LLC
7324 South Union Park Avenue, Suite 100, Midvale, Utah 84047 • 801.561.1555 • FAX 801.561.1861

EarthFax

January 26, 2015

Mr. Kyle Edwards
Bowie Refined Coal
1865 West Ridge Road
Wellington, UT 84654

Subject: Deer Creek Waste Rock Site
Road Certification

Dear Mr. Edwards:

I have examined the access road associated with the Deer Creek waste rock site in Emery County, Utah. Based on my field evaluation and understanding of operations planned for the site, it is my opinion that the road, as constructed, provides adequate environmental protection and safety appropriate for its planned life and use. If the type and size of equipment that is planned for coal recovery operations at the site is operated in a safe manner, it is my opinion that the roadway grades, widths, and surface materials will adequately serve site needs.

It is further my opinion that the roadway has been constructed to provide adequate drainage control. I have reviewed the hydrologic calculations associated with these structures and believe that their design is sufficient to pass the peak runoff safely from the 100-year, 6-hour precipitation event.

Based on my review, I hereby certify that the roads meet the requirements of R645-301-534.200 and R645-301-742.420.

Please contact me if you have any questions.

Sincerely,

Richard B. White, P.E.
President
EarthFax Engineering Group, LLC

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
26 Jan 2015
STATE OF UTAH

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APPENDIX 5-2

Waste Rock Site Geotechnical Evaluation

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ROLLINS,
BROWN AND
GUNNELL,
INC.
1435 WEST 820 NORTH
PROVO, UTAH 84601
(801) 374-5771

WASTE ROCK STORAGE FACILITY

Deer Creek Coal Mine

Utah Power & Light Co.
Emery County

August 1988

Soil & Foundation Investigation

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WASTE ROCK STORAGE FACILITY

Deer Creek Coal Mine

Utah Power & Light Co
Emery County

Soil & Foundation Investigation

ROLLINS, BROWN AND GUNNELL, INC.
Professional Engineers

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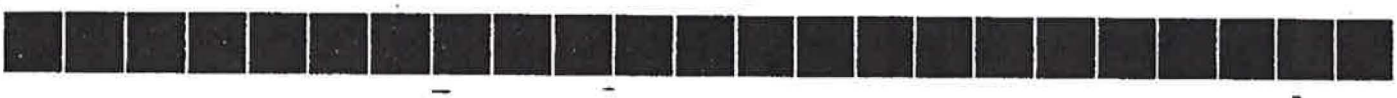

ROLLINS, BROWN AND GUNNELL, INC.
1435 WEST 820 NORTH
PROVO, UTAH 84601
(801) 374-5771

August 9, 1988

Utah Power & Light Company
Mining Division
P.O. Box 310
Huntington, Utah 84528

Attn: Greg Cowan

Gentlemen:

In accordance with your request, we have completed a geotechnical investigation for the proposed waste rock storage facility at the Deer Creek Coal Mine in Huntington Canyon, Utah. The primary purpose of the investigation was to define the characteristics of the subsurface material throughout the soil profile in the waste rock storage area and to determine the slopes at which the rock pile could be safely constructed. The work has been completed in accordance with a modified proposal submitted to your organization for the work and the results of the investigation along with recommendations for constructing the slopes are outlined in the following sections of this report.

The information contained in the report is discussed under the following headings: (1) Existing Site Conditions, (2) Subsurface Soil and Water Conditions, (3) Slope Stability Considerations, and (4) The Results of Field and Laboratory Tests.

1. EXISTING SITE CONDITIONS

The proposed waste rock storage facility is located on the northeast side of State Highway 31, approximately 6 miles west of Huntington, Utah. The general features of the site are presented in Figure No. 1. The areas are designated as Area No. 1 and Area No. 2 and it

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will be noted that the vegetative cover throughout the area is sparse and that the topography has generally rolling characteristics. A storage reservoir constructed to serve the power plant is located immediately southwest of the rock storage site. The soils throughout the proposed site are residual materials formed from the weathering of the shale which exists throughout the area. The area where the storage facility will be located is virgin terrain and no man-made fill exists throughout the site.

An irrigated area is located on the bench land north of the site which could effect the ground water in the area. Although some drainage channels exist throughout the general area, no water conveyance facilities other than the Huntington River appear to exist at this site which would affect the ground water level in the area. It is possible that some seepage could occur into the area from the reservoir located southwest of the site. The proposed site is located in seismic zone 2 according to the Uniform Building Code.

Other than the information provided above, no environmental factors appear to exist at this site which would affect the performance of the proposed structure.

2. SUBSURFACE SOIL AND WATER CONDITIONS

The characteristics of the subsurface material throughout the proposed site were defined by drilling two test holes to depths of approximately eighty feet at the approximate locations as shown in Figure No. 1. It will be observed that Test Hole No. 1 was drilled in Area No. 1 while Test Hole No. 2 was drilled in Area No. 2. The logs for these two test holes are presented in Figures 2 and 3 and it will be noted that the overburden material extends to a depth of approximately 15 to 16 feet in both test holes. The overburden material in Test Hole No. 1 generally consisted of a sandy gravel in a matrix of clay while in Test Hole No. 2, the subsurface material consisted of a gray weathered shale. Below a depth of 15 to 16 feet, the subsurface material throughout the depth investigated consisted of a dark gray shale.

In the upper 15 to 16 feet of the soil profile, sampling was performed at three-foot intervals throughout the depth investigated. Both disturbed and undisturbed samples were obtained during the field investigations. Disturbed samples were obtained by driving a 2-inch, split-spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling

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4-36

spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts which represents the number of blows to drive the sampling spoon through 12 inches is defined as the standard penetration value. The standard penetration value provides a reasonable indication of the in-place density of sandy material; however, it only provides an indication of the relative stiffness of cohesive material since the penetration resistance in materials of this type is a function of the moisture content.

The standard penetration test only provides a good indication of the in-place density of gravelly-type material when the spoon can be driven through a distance of 18 inches with a reasonably good core recovery. The results of the standard penetration test performed in the drill holes at this site indicate that the cohesive material is in a medium stiff condition.

Undisturbed samples are obtained in Test Hole No. 2 by pushing a 2.5 inch, thin-walled shelby tube into the subsurface material using the hydraulic pressure on the drill rig. The locations where the undisturbed samples were obtained are shown on the boring logs. The in-place density and the natural moisture content were determined for the cohesive material in Test Hole No. 2 and the results of these tests are shown on the boring logs. It will be observed that the in-place density varies about 108 pounds pcf to 117 pounds pcf. In-place unit weights of this magnitude is compatible with the density of these materials indicated by the standard penetration value.

Each sample obtained in the field was classified in the laboratory according to the Unified Soil Classification System. The symbol designating the soil type according to this system is presented on the boring logs. A description of the Unified Soil Classification System is presented in Figure No. 4 and the meaning of the various symbols shown on the boring logs can be obtained from this figure. It will be observed that the cohesive material in the upper portion of the soil profile is generally classified as a CL-1 or CL-2 type material. This means that the cohesive material throughout the development area is low plasticity silts and clays.

Continuous cores were obtained in the bedrock in both test holes. Parameters used to characterize the bedrock throughout each test hole included the percent core recovery and the rock quality designation. The rock quality designation gives the percent of core which has a length greater than 4 inches. It

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will be observed from Figures 1 and 2 that the percent core recovery was nearly 100% in both test holes. The rock quality designation was a little less than this value and generally varied from about 85% to 100%. Based upon the percent core recovery and the rock quality designation, the shale throughout the proposed site would be considered as competent rock.

Field permeability tests were performed at approximately ten-foot intervals throughout the depth drilled in each test hole. The field permeability tests were performed in accordance with designation E-18 of the U.S. Bureau of Reclamation Earth Manual. The permeability coefficient expressed in feet per year is tabulated on the boring logs for the various test intervals. It will be observed that in Test Hole No. 1, the subsurface material was relatively impervious in the upper 43 feet of the soil profile. Below this depth, however, the permeability coefficient varied from 347 fpy to 763 fpy. In Test Hole No. 2, the subsurface material was relatively impervious in the upper 38 feet of the soil profile. The interval from 38 to 48 feet below the ground surface indicated a permeability coefficient of 263 fpy. Below this interval, the permeability coefficient for the shale material is relatively low. A 3-inch ID Perforated PVC Pipe was installed in each test hole.

During the subsurface investigation, ground water was encountered in Test Hole Nos. 1 and 2 at approximately 33 feet and 28 feet respectively below the existing ground surface. The equilibrium ground water level at the end of drilling is shown on the boring logs. It will be noted that the ground water level existed at about 23 feet below the ground surface in Test Hole No. 1 and about 7 feet below the ground surface in Test Hole No. 2. Following the completion of each test hole, the water in the drill hole was blown out several times using an air compressor. The ground water level recovered within a period of about two hours and reached the equilibrium position shown on the boring logs.

It is our opinion that water is entering the drill hole in Test Hole No. 1 below a depth of 43 feet while the ground water is entering the profile in Test Hole No. 2 at a depth between 38 and 48 feet below the ground surface. The source of the artesian flow in each of the Test Holes are not known as of the preparation of this report. Several possible sources exist where the water could be coming from. A possible source would be the Huntington River upstream from the site. The high water level in the pond south of the site is several feet below the ground surface at each of the drill holes and it is doubtful that this is the source of water in the drill holes. The topography rises

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upward to the north and west of the site and the source of the water could come from this direction. An irrigated farm is located on a plateau north of the site and is a possible source of the underground flow.

3. SLOPE STABILITY CONSIDERATIONS

It is our understanding that the waste rock storage facility will eventually cover both Areas 1 and 2 as shown in Figure No. 1. The maximum height of the rock storage facility will be approximately 60 feet and it is anticipated that this material will have a gradation curve defined approximately by Figure No. 5. It is expected that the rock material will be placed in the fill in lifts not exceeding two feet and that it will be densified to at least 95% of the maximum laboratory density as determined by ASTM D-698. Triaxial shear tests were performed on the minus one-half inch fraction of the waste rock materials densified to nearly 100% of the maximum laboratory density as determined by ASTM D-1557 indicated this material had a friction angle of 40.5 degrees. Since the actual density of the in-place material will be somewhat lower than the density at which the triaxial shear test was performed, and inasmuch as it is known that the friction angle of granular materials decreases as the particle size increases, stability computations performed during this investigation used a friction angle of 36 degrees for the waste rock material.

As indicated earlier in this report, the soil profile where the waste rock facility will be located consists of 15 feet of weathered shale underlain by a competent shale material which extended to the depth at which the borings where terminated in the vicinity of 80 feet below the ground surface. The results of consolidated drained direct shear tests and consolidated drained triaxial tests indicate that the friction angle for the weathered shale varies from about 25 degrees to 32 degrees and that the cohesion varies from about 4 psi to 9 psi. The results of the shear test performed on the shale material underlying the surface cohesive zone indicates that the unconfined compressive strength of this material is in excess of 1600 pounds psi.

A computer model of Spencer's method known as UTexas 2 was used in performing the stability computations for this site. Spencer's method satisfies both force and moment equilibrium and is currently a standard method used by the Corps of Engineers. An effective stress analysis was used in performing the stability computations for the proposed waste storage facility. The analysis was first performed assuming that the piezometric line existed at the ground surface. The factor of safety for various

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side slopes using a range in the shear strength parameters was performed for this condition. The results of the analysis are summarized below in Table No. 1.

Table 1

Summary of Stability Analysis
Utah Power & Light Waste Pile

Case	Rock Waste Properties		Foundation Properties		Slope	F.S.
UPL.1*	ϕ =36°	C=0	ϕ=26°	C=50psf	1.75H:1V	1.39
UPL.2*	ϕ =36°	C=0	ϕ=26°	C=50psf	2.0H:1V	1.46
UPL.3*	ϕ =36°	C=0	ϕ=26°	C=50psf	2.25H:1V	1.50
UPL.4*	ϕ =36°	C=0	ϕ=32°	C=0psf	1.75H:1V	1.48
UPL.5*	ϕ =36°	C=0	ϕ=32°	C=0psf	2.0H:1V	1.62
UPL.6*	ϕ =36°	C=0	ϕ=32°	C=0psf	2.25H:1V	
UPL.7**	ϕ =36°	C=0	ϕ=26°	C=50psf	2.0H:1V	1.46 1.62
UPL.8**	ϕ =36°	C=0	ϕ=26°	C=50psf	1.75H:1V	1.50

* water table at ground surface
** water level well below the surface of the shale

It will be observed from this table that a factor of safety of 1.5 is obtained for side slopes of 2 to 1 using a friction angle of 26 degrees and a cohesion of 50 psf for the foundation material. The critical failure surface along with the side slopes and the shear strength parameters are presented in Figure No. 6.

While it is possible that the piezometric surface may exist at the ground surface at some time throughout the life of this structure, it is our opinion that this assumption is unduly conservative and that the factor of safety should be determined for the rock storage facility assuming that the piezometric surface is well below the surface of the shale zone. A stability analysis has therefore been performed assuming the shear strength parameters shown in Figure No. 6 for side slopes of 2 horizontal, 1 vertical and 1.75 horizontal, 1 vertical. With the piezometric surface below the surface of the shale, the factor of safety for side slopes of 1.75 horizontal to 1 vertical is equal to 1.5. The critical failure surface for this condition is shown in Figure No. 6. It is our recommendation, therefore, that the waste rock storage facility be constructed using side slopes of 1.75 horizontal to 1 vertical. The top of the waste rock facility should be covered with compacted cohesive material and sloped so that surface drainage will readily occur.

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4. THE RESULTS OF FIELD AND LABORATORY TESTS

Field and laboratory tests performed during this investigation to define the characteristics of the subsurface material included: standard penetration test, in-place permeability test, in-place unit weight, natural moisture content, Atterberg Limits, unconfined compressive strength, consolidated drain direct shear tests, and consolidated drain triaxial shear tests. The standard penetration test and the field permeability test have been previously discussed and the results of these tests are shown on the boring logs. A summary of all other test data performed during the investigation with the exception of the direct shear test and the triaxial shear test are presented in Table No. 2, Summary of Test Data.

It will be observed that the plastic index of the weathered shale material in the upper portion of the soil profile varies from about 17.5 to 21.1 and that this material classifies as a CL-2 type material according to the Unified Soil Classification System. It should also be noted that the natural moisture content is within a few percentage points of the plastic limit. The plastic index of the shale material underlying the surface weathered zone varies from about 6.5 to 12 indicating that this material has low plasticity characteristics. This material classifies as a CL-1 type soil according to the Unified Soil Classification System.

Several unconfined compression tests were performed on samples of the shale throughout the soil profile and the results of these tests indicate that the unconfined compressive strength increases with depth and that it varies from about 1600 pounds psi to as high as 3300 pounds psi.

In order to obtain an indication of the shearing strength of the cohesive material overlying the shale, six direct shear tests were performed on representative samples obtained from a depth of 5 feet and 10 feet below the existing ground surface. The results of these tests are expressed in the form of a mohr envelope in Figure Nos. 7 and 8. These tests indicate a friction angle of about 25 degrees and a cohesion of about 4 psi.

Three consolidated drain triaxial shear tests were performed on the weathered shale at a depth of about 6 feet below the existing ground surface. The triaxial shear tests are expressed in the form of a mohr envelope as shown in Figure No. 9. These tests indicate a friction angle of 32 degrees and a cohesion of 9 psi, which is somewhat larger than the value obtained in the direct shear test.

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The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which in our opinion define the characteristics of the subsurface material throughout the site in a satisfactory manner. If there are any questions relative to the information contained herein, please advise us.

Yours truly,

ROLLINS, BROWN AND GUNNELL, INC.

Ralph L. Rollins

Ralph L. Rollins

RLR:jsh

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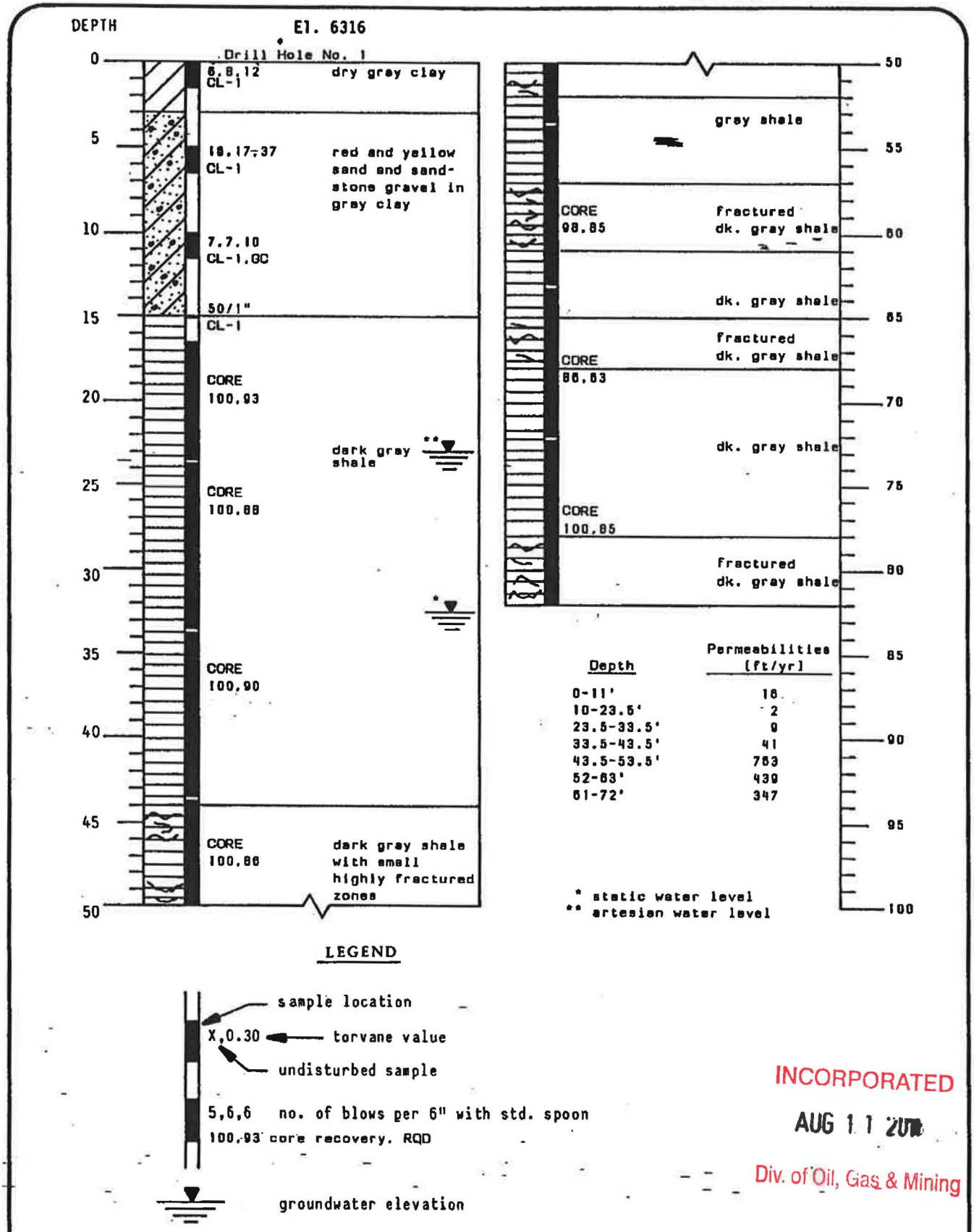

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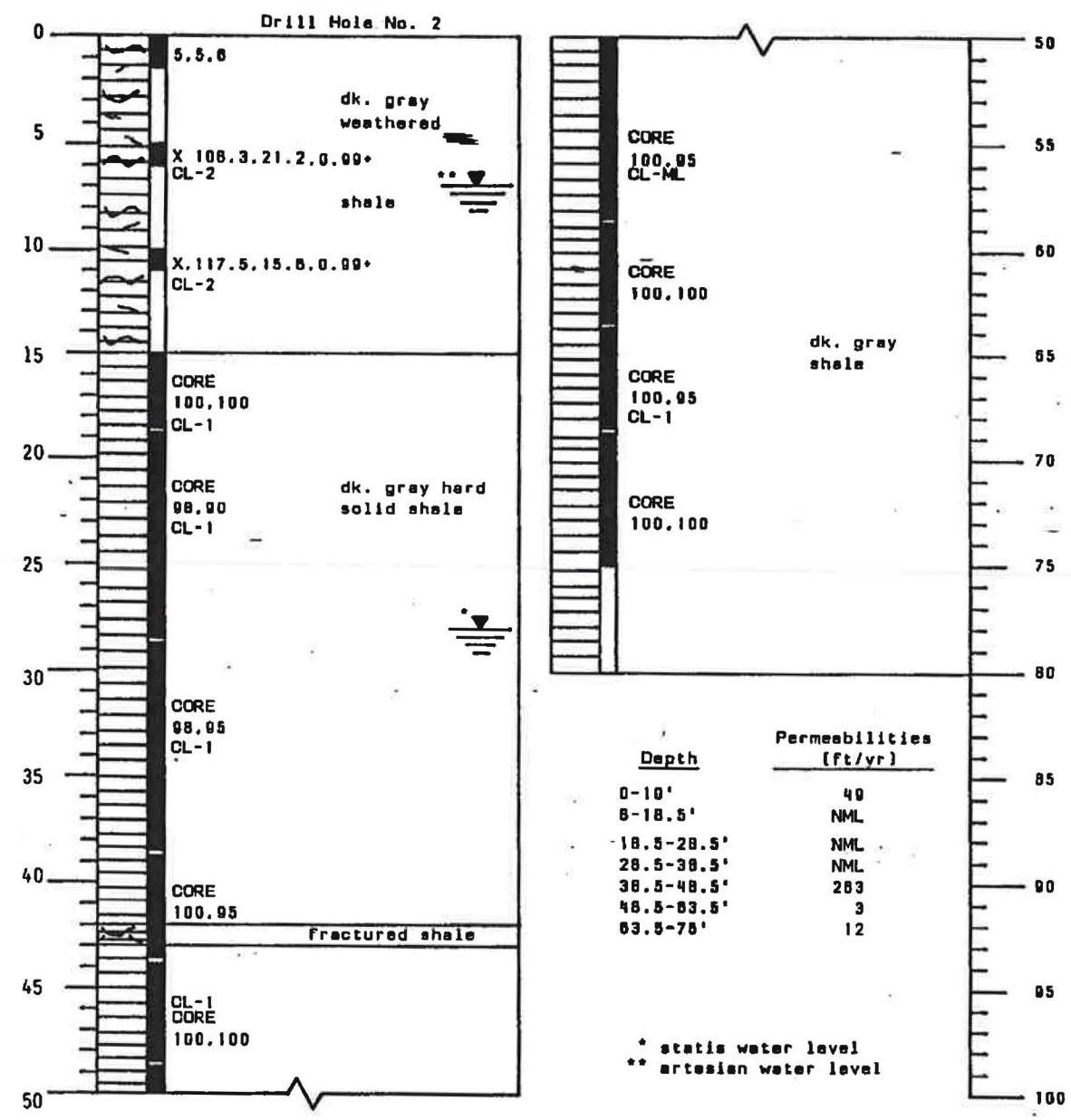
Log of Borings for:
Deer Creek Mine Waste Pile
Utah Power & Light

Figure No. 2

4-44



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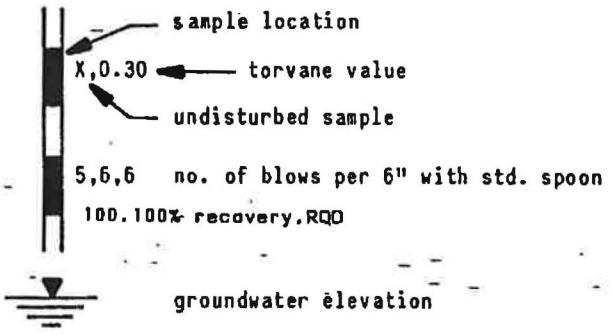

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Log of Borings for:
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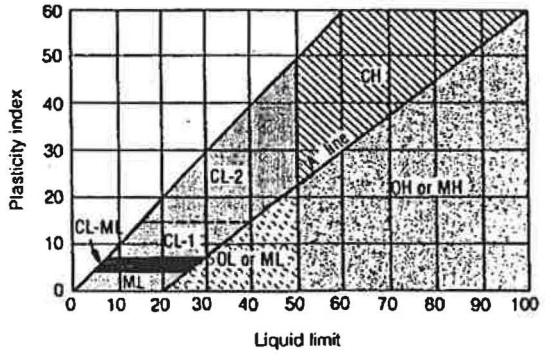
Figure No. 3

Unified Soil Classification System

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-grained Soils: More than half of material is larger than No. 200 sieve	Gravels: More than half of coarse fraction is larger than No. 4 sieve size	Clean Gravels (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	Determine percentage of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5% ..... GW, GP, SW, SP; More than 12% ..... GM, GC, SM, SC; 5% to 12% ..... Borderline cases requiring use of dual symbols**	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, or PI greater than 7	
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines.		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			SC	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or PI greater than 7	
Fine-grained Soils: More than half of material is smaller than No. 200 sieve	Silt and Clays: Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity			
			CL 1 / 2	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silt-clays of low plasticity			
	Silts and Clays: Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
Highly Organic Soils			Pt	Peat and other highly organic soils			



Plasticity Chart
For laboratory classification of fine-grained soils

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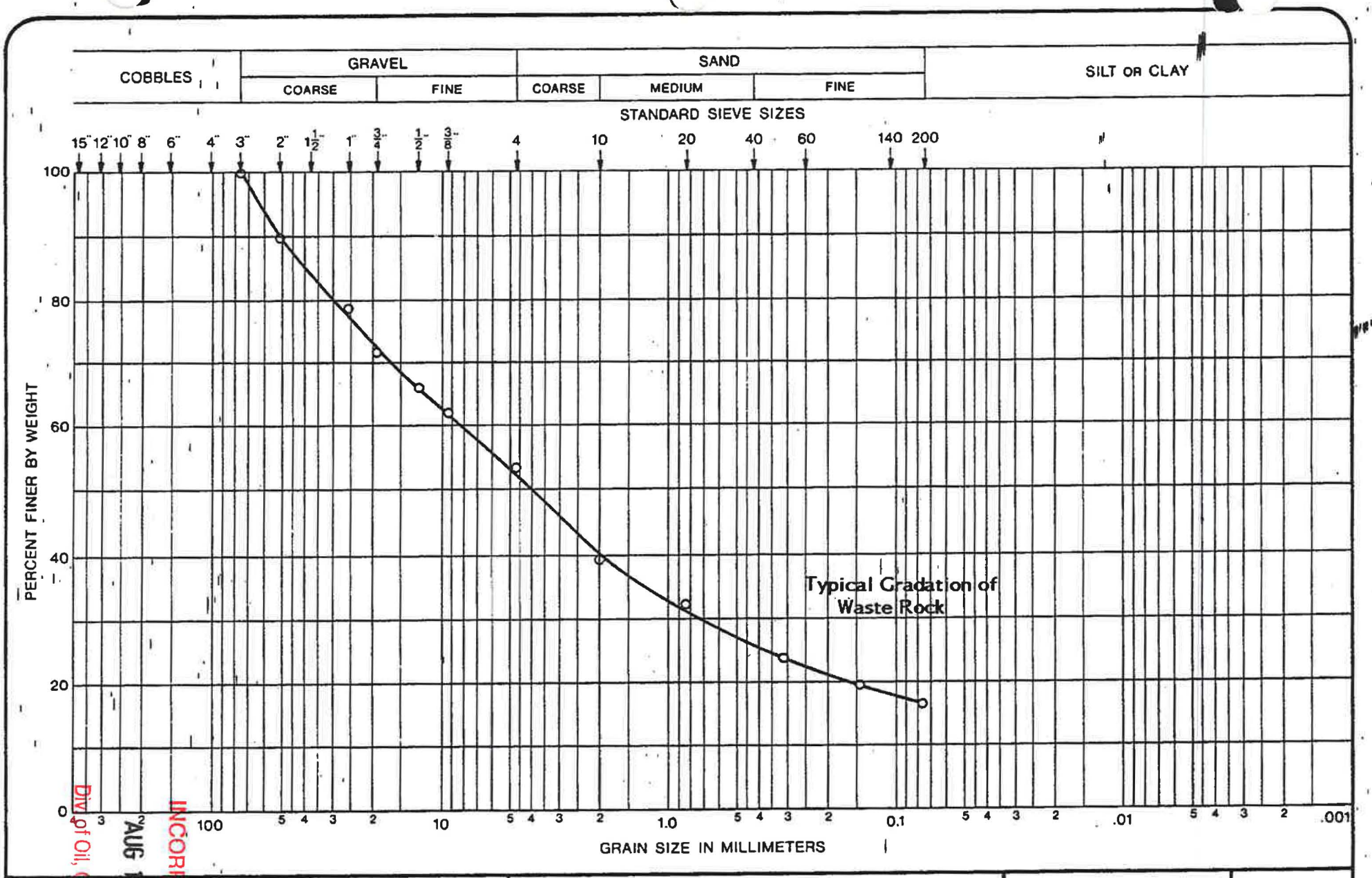
*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

**Borderline classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.

Figure No. 4



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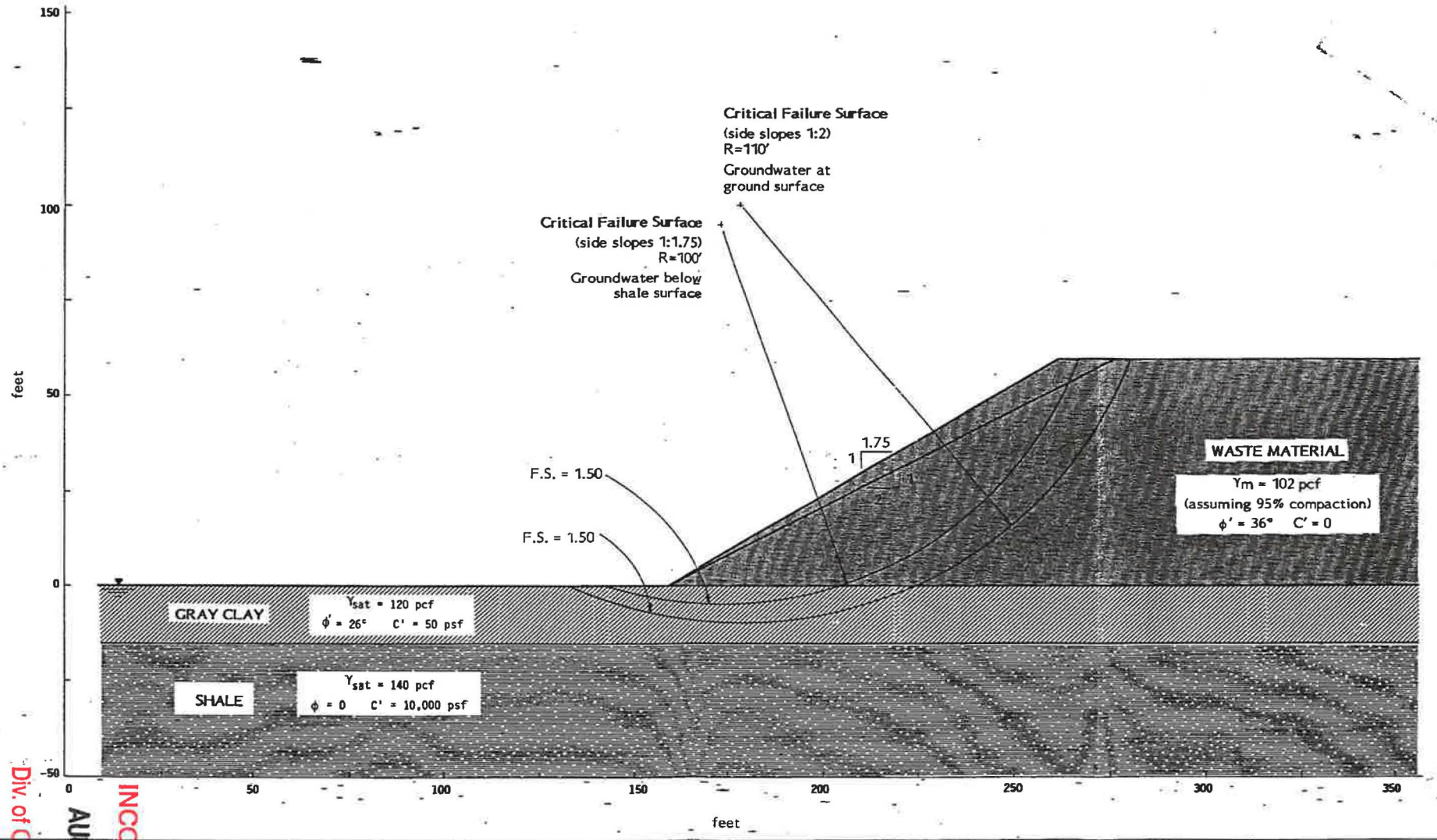
GRAIN SIZE DISTRIBUTION CURVE

Project: Waste Rock Storage Facility

Location: Huntington Canyon

Sample No. 1

FIGURE NO. 5



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SLOPE STABILITY SUMMARY
Deer Creek Coal Mine

FIGURE NO. 6

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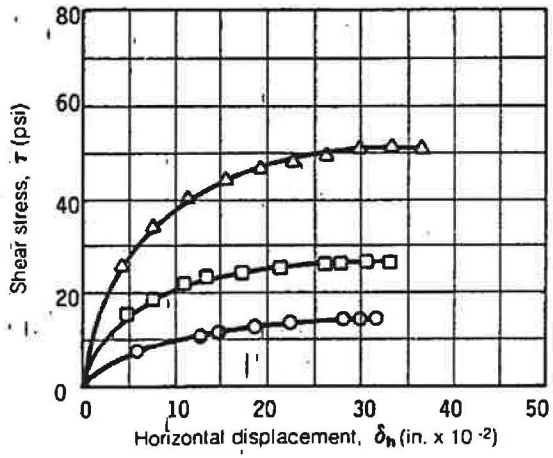

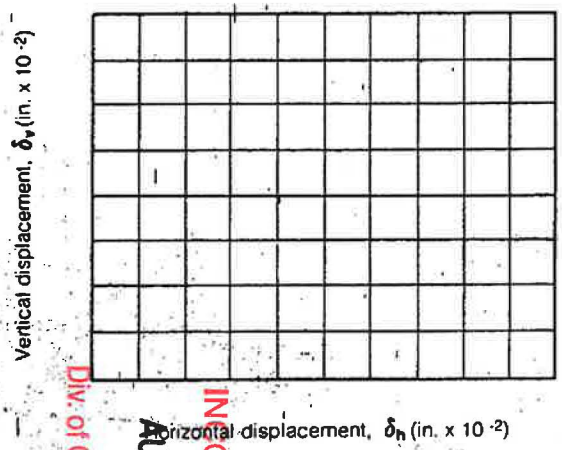

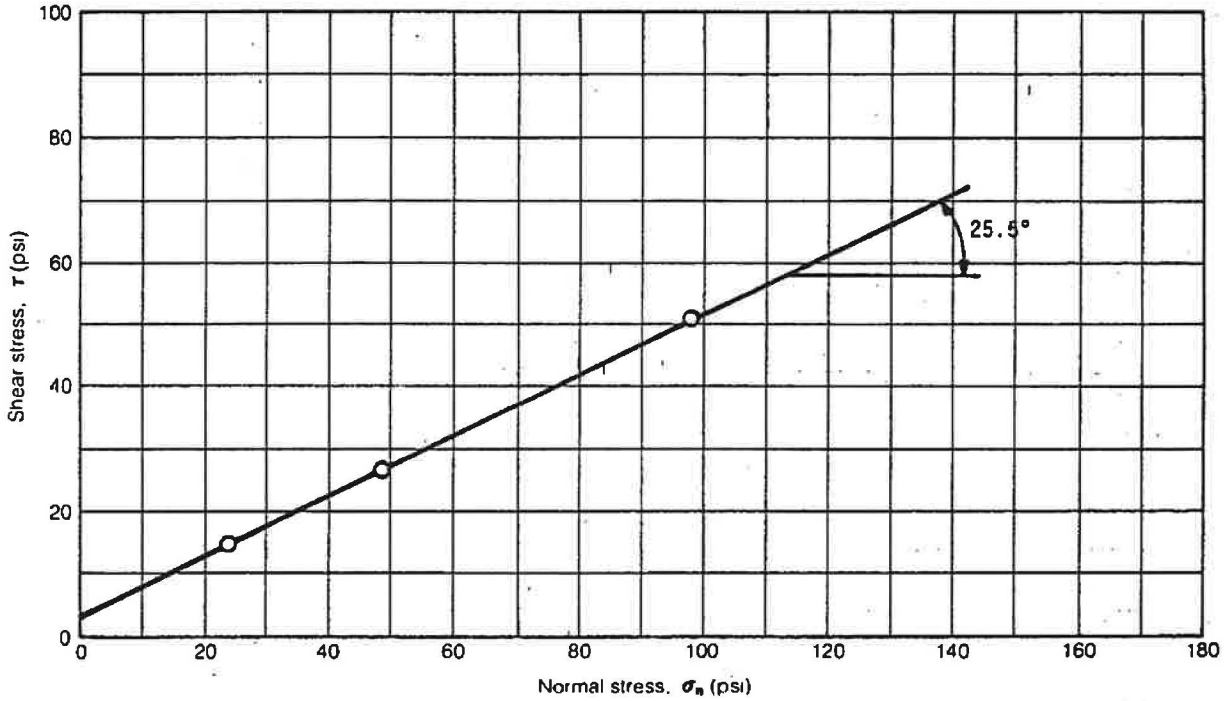

Test no. or symbol	Sample size (inches)	Sample data: Dry density (pcf)	Sample data: Moisture content (%)	Degree of saturation (%)	Normal stress σ_n (psi)	Maximum shear stress τ (psi)	Strain rate (inches / minute)	Shear strength parameters: Friction angle φ (degrees)	Shear strength parameters: Cohesion (c / psi)
○	2.375	108.3	21.2	100	23.7	14.4	0.0006	25.5°	3
□	2.375	106.8	22.7	100	48.2	26.8	0.0006		
△	2.375	108.3	20.8	100	97.8	51.0	0.0006		

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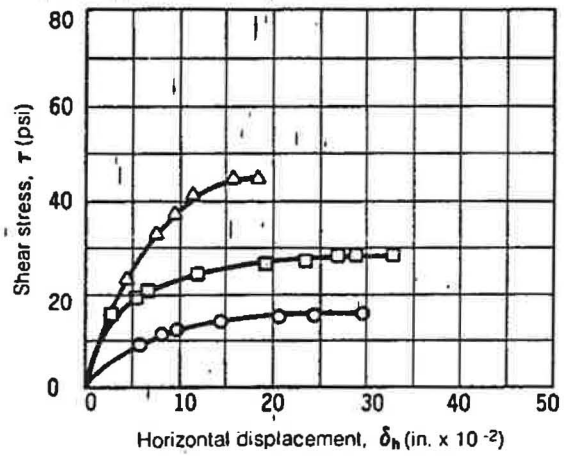
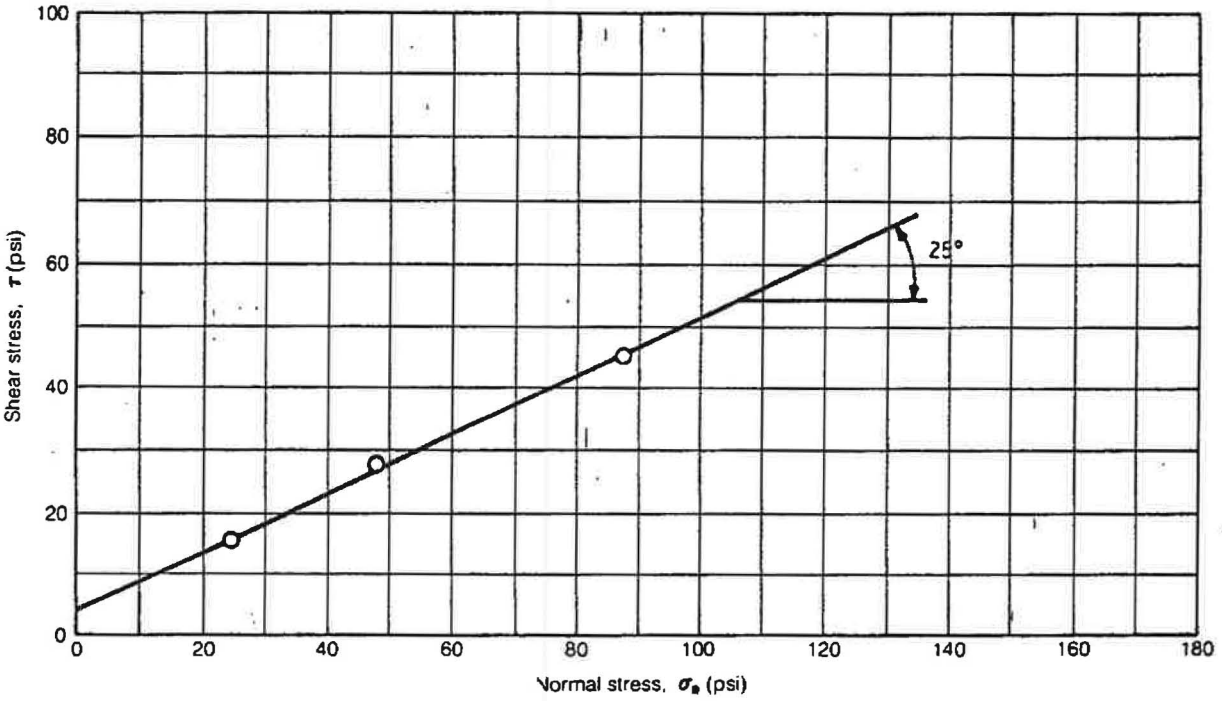
DIRECT SHEAR TEST
Project: Deer Creek Mine Waste Pile
Utah Power & Light

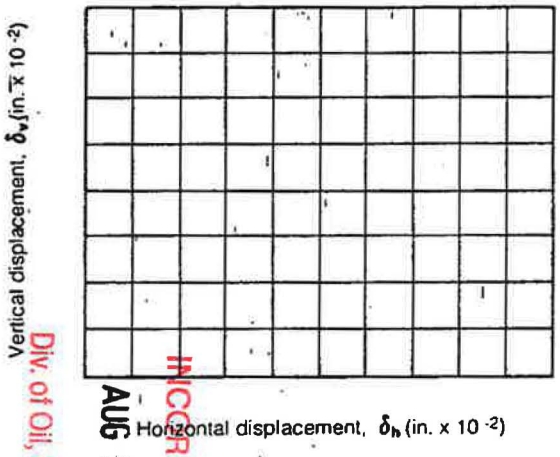
HOLE NO. 2
DEPTH: 5'

FIGURE NO. 7

4-49







Test no. or symbol	Sample size (inches)	Sample data: Dry density (pcf)	Sample data: Moisture content (%)	Degree of saturation (%)	Normal stress σ_n (psi)	Maximum shear stress τ (psi)	Strain rate (inches / minute)	Shear strength parameters: Friction angle ϕ (degrees)	Shear strength parameters: Cohesion (c / psi)
○	2.375	117.6	14.4		23.7	15.9	.0006	25°	4
□	2.375	117.4	15.9		48.2	28.7	.0006		
△	2.375	117.5	16.6		87.9	45.2	.0006		

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DIRECT SHEAR TEST

Project: Deer Creek Mine Waste Pile
Utah Power & Light

HOLE NO. 2
DEPTH: 10-11'

FIGURE NO. 8

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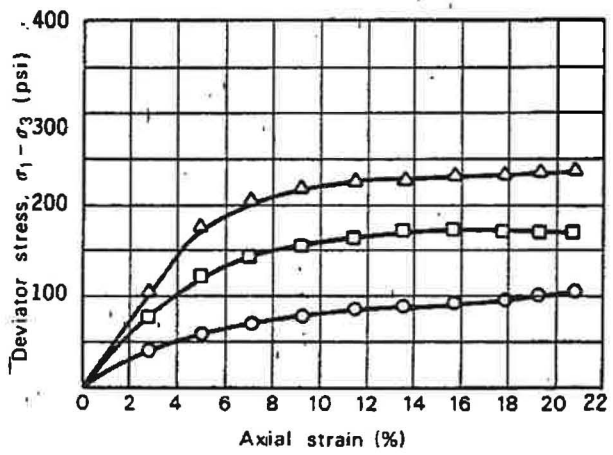

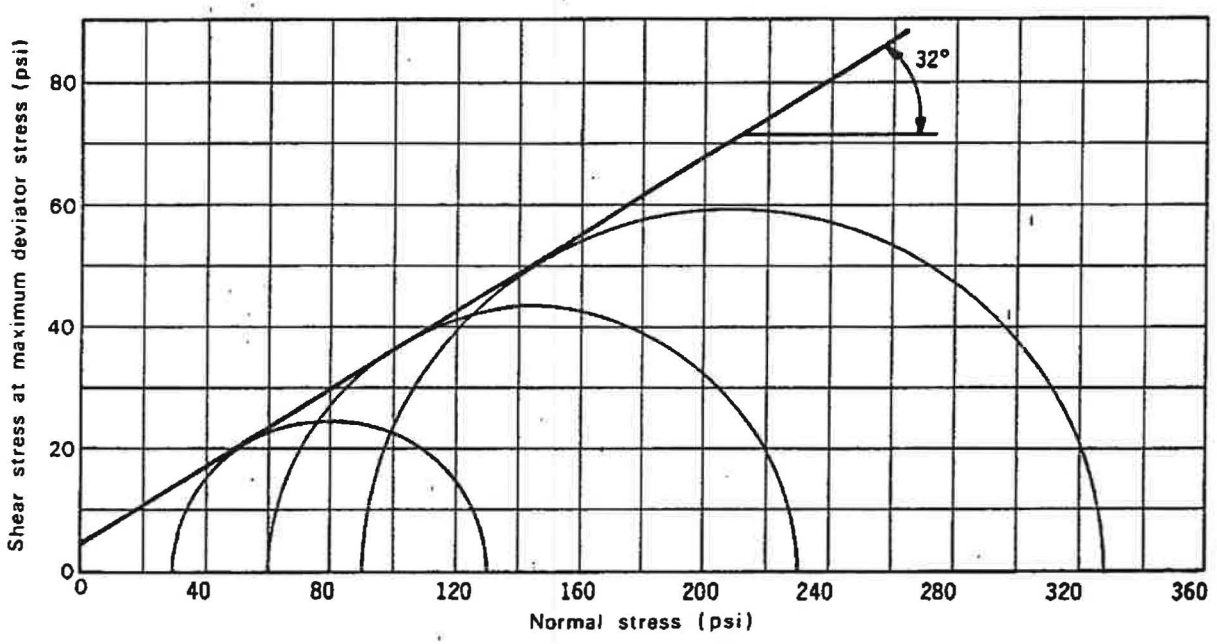

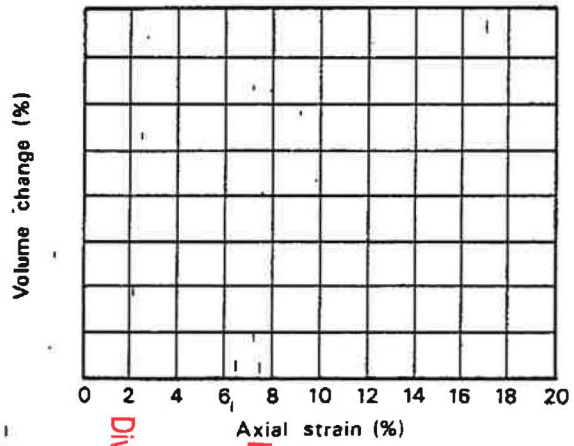

Test no. or symbol	Boring no. or depth	Sample data		Degree of saturation (%)	Confining pressure (psi)	Maximum deviator stress (psi)	Strength values at failure		Sample size, l/D (inches)	Strain rate (inches/minute)
		Dry density (pcf)	Moisture content (%)				Friction angle ϕ (degrees)	Cohesion (c/psi)		
○	1	108.3	21.2		30	133	32	9	2.8/1.32	.002
□	2	108.3	21.2		60	232				.002
△	3	108.3	21.2		90	327				.002

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TRIAXIAL SHEAR TEST
Project: Deer Creek Mine Waste Pile
Utah Power & Light

HOLE NO. 2
DEPTH: 6'

FIGURE NO. 9

Table No. 2 SUMMARY OF TEST DATA

Project Deer Creek Mine Waste Pile Feature _____ Location Near: Huntington, Utah

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE			UNCONFINED COMPRESSIVE STRENGTH (lb/ft²)	FRICTION ANGLE ϕ	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM
			Unit Weight (lb/ft³)	Moisture (%)	Void Ratio			L.L. (%)	P.L. (%)	P.I. (%)	% Gravel	% Sand	% Silt & Clay	
2	5-6.5'		108.3	21.2				38.9	17.8	21.1				CL-2
	10-11.5'		117.5	15.6				39.6	22.1	17.5				CL-2
	15					1612		27.3	15.3	12.0				CL-1
	25					2287		22.5	14.5	8.0				CL-1
	35					2897		22.1	14.2	7.9				CL-1
	45					2954		23.5	15.3	8.2				CL-1
	55					3023		21.4	14.9	6.5				CL-ML
	65					3338		20.7	11.6	9.1				CL-1

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APPENDIX 5-3

Stability Evaluation of Site Access Road and
Sedimentation Pond

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Deer Creek Waste Rock Site
Sedimentation Pond and Haul Road
Slope Stability Analyses

BRC Wellington, LLC
Mouth of Huntington Canyon
Emery County, Utah

February 2016

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CHAPTER 2 -	SITE SOILS	1
CHAPTER 3 -	EVALUATION METHODS	1
3.1	SEDIMENTATION POND EMBANKMENT	1
3.2	HAUL ROAD	2
3.3	SOIL PROPERTIES USED FOR SLIDE ANALYSES	2
CHAPTER 4 -	RESULTS	3
CHAPTER 5 -	REFERENCES CITED	3

TABLES

TABLE 1 Results of *Slide* Analyses

APPENDICES

APPENDIX A Site Map (Markup of Plate 5-1)
APPENDIX B *Slide* Geometry and Output

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DEER CREEK WASTE ROCK SITE
SEDIMENTATION POND AND HAUL ROAD
SLOPE STABILITY ANALYSES

1.0 INTRODUCTION

The purpose of this report is to summarize the methods and findings of slope stability analyses performed for the sedimentation pond and haul road constructed at the Deer Creek Waste Rock Site near the mouth of Huntington Canyon, Emery County, Utah. Both the haul road and sedimentation pond have been constructed and their locations are shown on Plate 5-1 included as Appendix A.

2.0 SITE SOILS

A geotechnical investigation at the Deer Creek Waste Rock site was performed in 1988 by Rollins, Brown, and Gunnel ("RBG"). Although this investigation focused on the stability and allowable configuration of the waste-rock pile itself, the investigation effectively characterized the site soils and their engineering properties and, as a result, will be used as the basis for the analyses included herein.

As discussed in the RBG report, near-surface soils at the site consist primarily of a sandy gravel in a matrix of clay and weathered shale. These soils are underlain by competent shale rock. Consolidated-drained direct shear and triaxial strength tests on the weathered shale material indicate a friction angle and cohesion that ranges from 25 to 32 degrees and 4 to 9 psi (600 to 1,300 psf), respectively.

3.0 EVALUATION METHODS

Slope stability analyses were performed using the slope stability software *Slide 5.0* ("*Slide*") by RocScience. This program uses an iterative procedure to evaluate the factor of safety against rotational shear failure for tens of thousands of potential failure surfaces that may develop within a given slope. Each trial failure surface is discretized into small slices and the driving and resisting forces/moments are calculated for each according to Bishop's Simplified Method of Slices. These forces are then summed over the entire failure surface to obtain a factor of safety defined as the sum of the resisting forces divided by the sum of the driving forces. Therefore, a factor of safety less than 1.0 indicates the potential for slope failure.

Details on each of the slope-stability scenarios analyzed and soil properties used for these analyses are included in the following sections.

3.1 SEDIMENTATION POND EMBANKMENT

Slope stability of the sedimentation pond embankment was evaluated near the pond's outlet where the embankment is tallest (see Appendix A). Analyses were performed for both the inner and outer slopes of the embankment.

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Stability of the pond embankment's outer slope was analyzed under the steady-state seepage condition. This condition assumes the sedimentation pond is completely full of water (maximum pool elevation of 6318 feet) with a phreatic surface fully developed within the embankment. The location of the phreatic surface was determined using *Slide*'s finite-element seepage sub-program and assumed hydraulic conductivities.

Slope stability of the inner slope was analyzed under a "rapid drawdown" condition. That is, the pond is quickly drained such that the buttressing effect of the pond water is lost but pore pressures developed during steady-state seepage remain trapped within the embankment, thus weakening the slope. This is the most critical condition for the inner slopes of the pond embankment.

3.2 HAUL ROAD

Cross sections were analyzed approximately every 100 feet along the haul road alignment in order to determine the location with the most-critical combination of slope height and slope gradient. This cross section was then analyzed within *Slide* under both the existing (road constructed) and post-reclamation condition. The location of this cross section is indicated on Plate 5-1 included as Appendix A.

Slope stability analyses for the haul road assume that the slope is dry (i.e., free from groundwater that would negatively affect slope stability). This is based on observations of haul road slopes at the site. If groundwater seepage is ever observed daylighting out of the haul road's cut or fill slopes, the slope stability of the haul road should be re-evaluated on a case-by-case basis and slope stabilization measures such as slope flattening or reinforcement taken as appropriate.

3.3 SOIL PROPERTIES USED FOR SLIDE ANALYSES

The following soil properties were used as input for the *Slide* analyses:

- Unit Weight. 120 pounds per cubic foot
- Friction Angle: 25 degrees
- Cohesion: 290 psf
- Hydraulic Conductivity: 10^{-7} cm/sec

As discussed above, these data were taken from the RBG geotechnical report (1988). Based on observations of soils at the site, it is assumed that the sedimentation pond, sedimentation pond embankment, and haul road soils consist entirely of weathered shale.

In the interest of conservatism, the friction angle for the weathered shale was taken as the lowest of the range presented from RBG's laboratory testing program. The soils cohesion was taken as 50% of the lowest value presented in RBG's report to account for construction-related soil disturbance. Lastly, the positive effect of any shale rock present within the haul road slopes was neglected in these analyses as slopes were assumed to be comprised entirely of soil.

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4.0 RESULTS

The calculated minimum factors of safety for the various scenarios described above are summarized in Table 1. Results of the *Slide* analyses are included as Appendix B. As shown in this table, the minimum factor of safety for the sedimentation pond embankment is 2.02. The minimum factor of safety for the haul road is 1.46.

The minimum acceptable factor of safety promulgated by the Utah Division of Oil, Gas, and Mining ("DOGM") for the sedimentation pond embankment is 1.3 under steady-state seepage conditions (R645-301.533.110). The minimum calculated factor of safety (2.02) is therefore considered acceptable and slopes are expected to remain stable under the geometry and loading conditions presented herein.

The minimum acceptable factor of safety promulgated by DOGM for the haul road embankment is also 1.3 (R645-301.534.130). The minimum calculated factor of safety (1.46) is therefore considered acceptable and slopes are expected to remain stable under the geometry and loading conditions presented herein. As discussed above, if any evidence of groundwater is observed along the haul road slopes in the future, the stability should be re-evaluated and slope stabilization measures taken as appropriate.

5.0 REFERENCES CITED

Rollins, Brown, and Gunnell, Inc. 1988. Soil and Foundation Investigation, Waste Rock Storage Facility, Deer Creek Coal Mine. Utah Power and Light Company, Emery County, Utah.

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TABLES

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TABLE 1
Results of *Slide* Analyses

Condition/ Location	Minimum Calculated Factor of Safety	Minimum Acceptable Factor of Safety
Sedimentation Pond Embankment Outslope with Steady-State Seepage	2.89	1.3
Sedimentation Pond Embankment Inslope with Rapid Drawdown	2.02	1.3
Haul Road at Critical Section (Existing Condition)	1.46	1.3
Haul Road at Critical Section (Post-Reclamation)	1.74	1.3

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APPENDIX A

Site Map (Markup of Plate 5-1)

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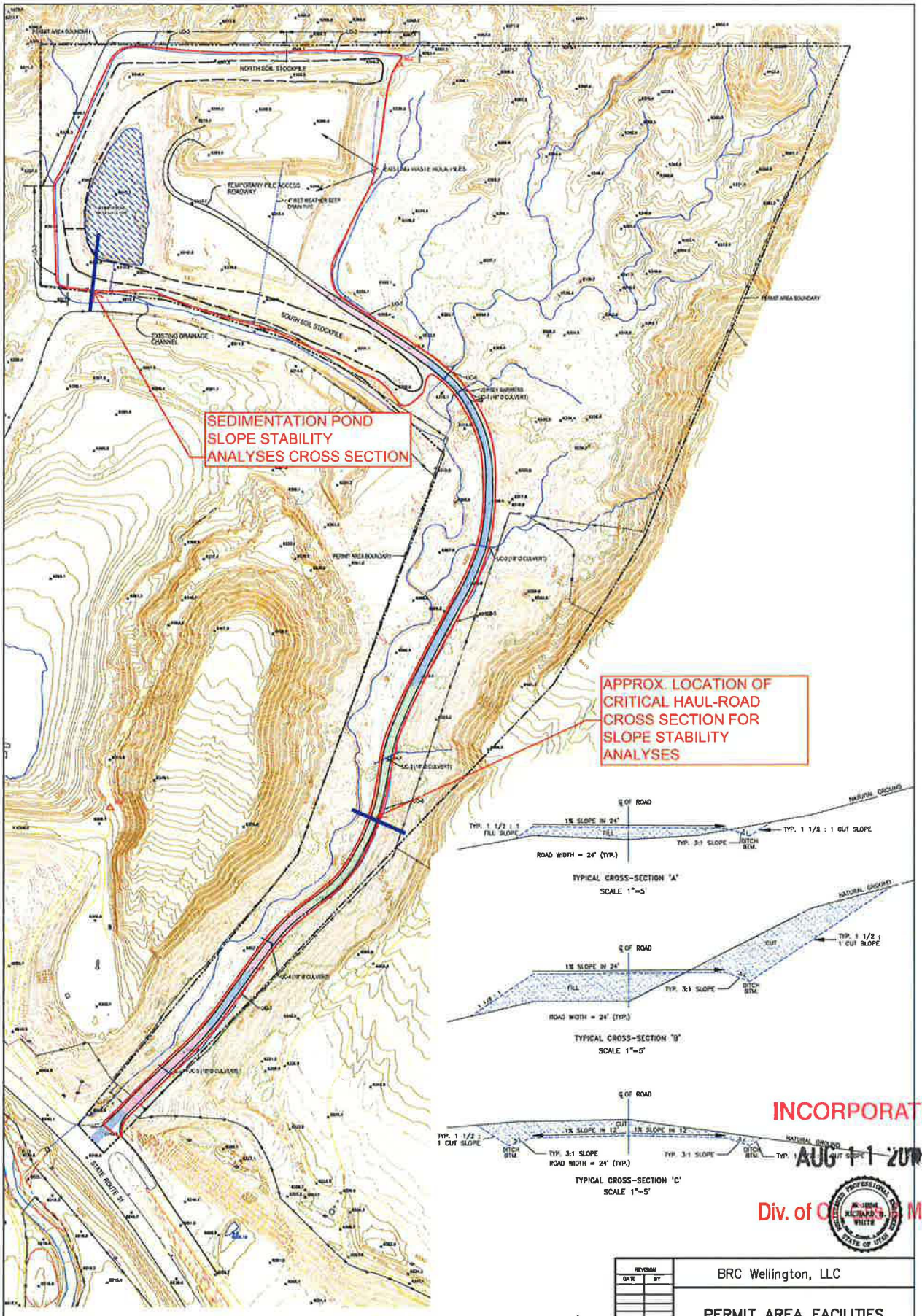

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REVISION DATE	BY

BRC Wellington, LLC

PERMIT AREA FACILITIES AND TYPICAL ROAD CROSS-SECTIONS

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHS | DATE: JAN 2013 | SCALE: 1"=100' OR AS NOTED

APPROVED BY: RBW | PROJ NUMBER: UCY4611/05 | DRAWING OR MAP NUMBER: PLATE 5-1

APPENDIX B

Slide Geometry and Output

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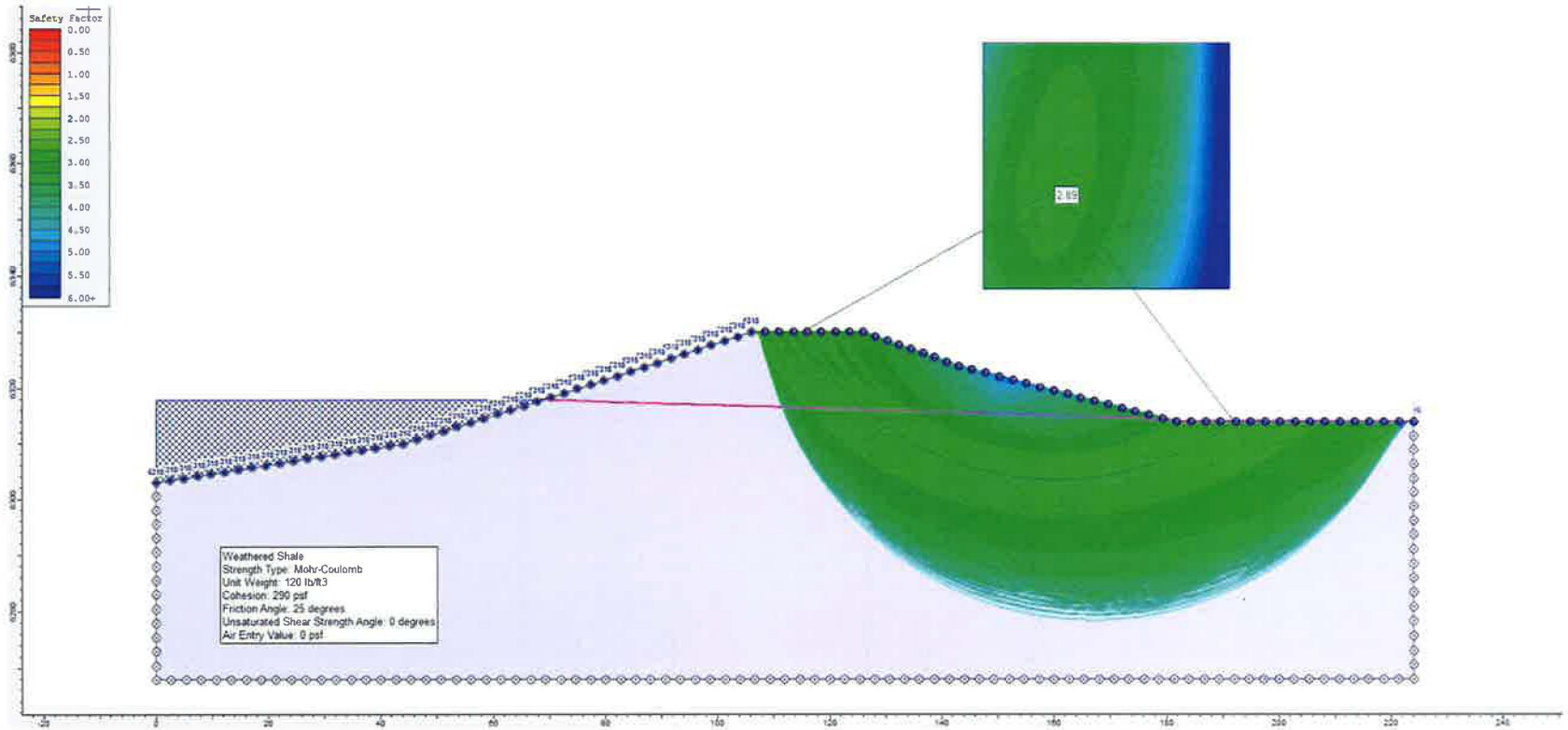

Figure B-1: Slide Geometry and Output for Analysis of Sedimentation Pond Outslope with Steady-State Seepage

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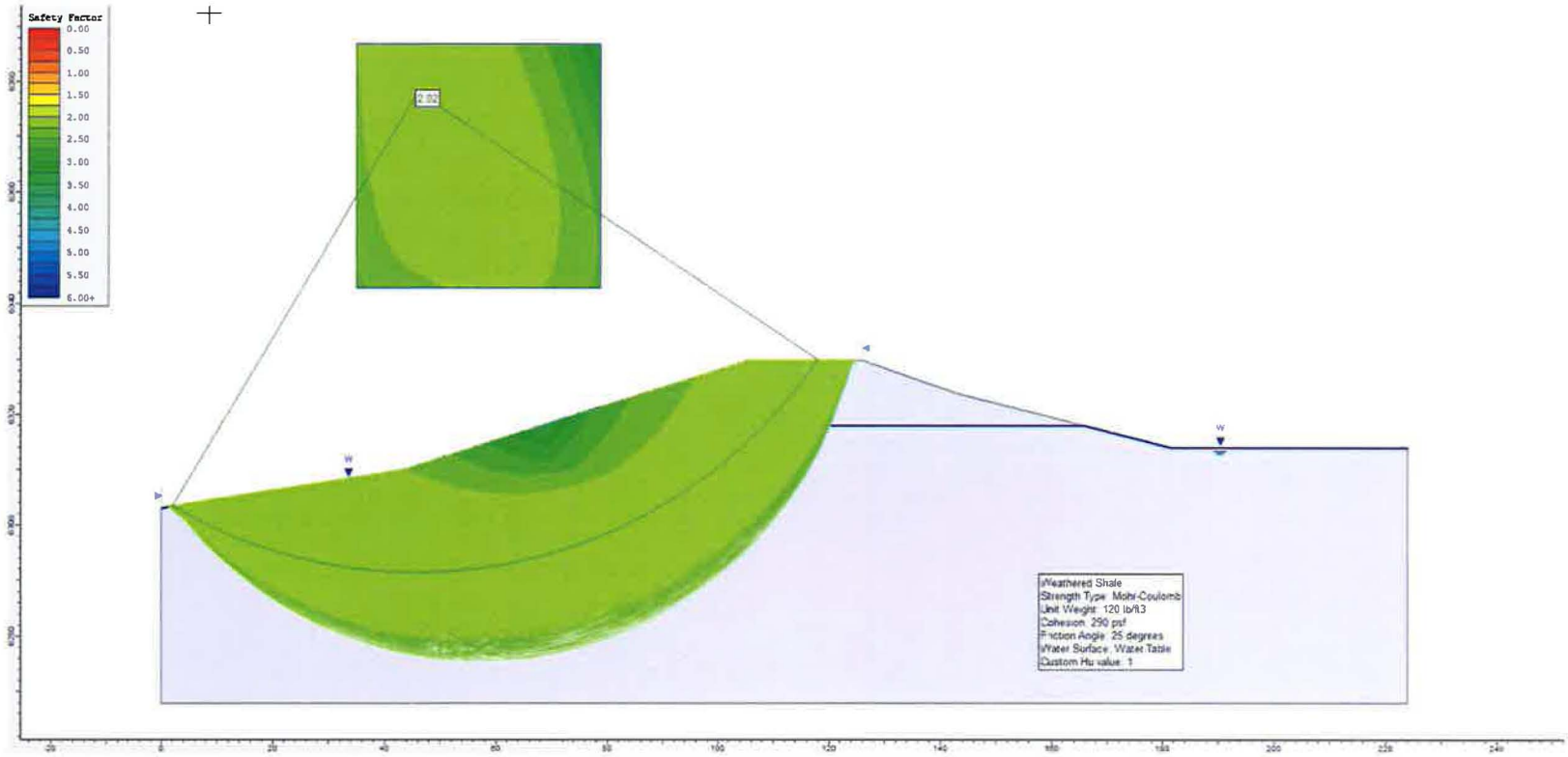

Figure B-2: Slide Geometry and Output for Analysis of Sedimentation Pond Inslope with Rapid-Drawdown

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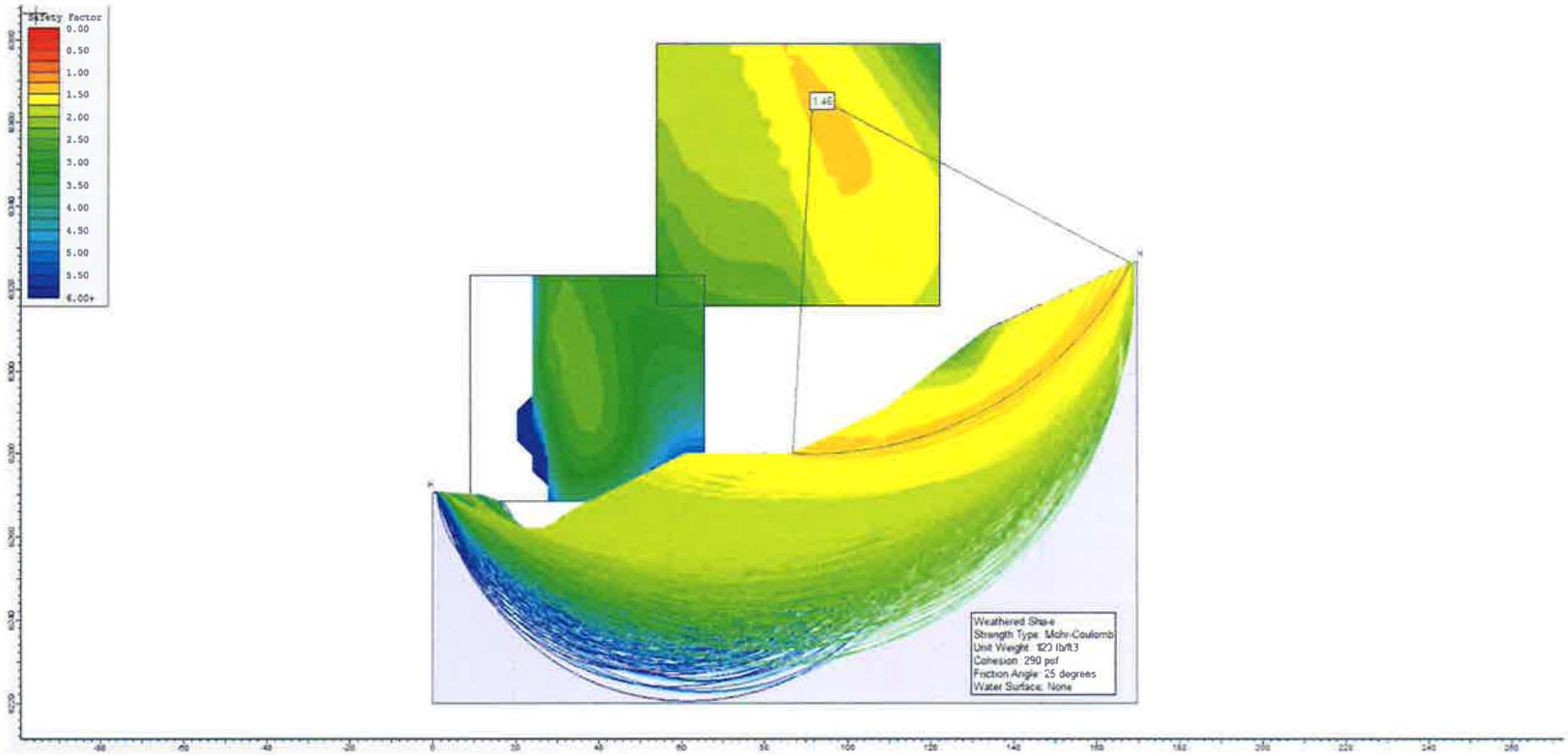

Figure B-1: Slide Geometry and Output for Analysis of Haul Road at Critical Section - Existing

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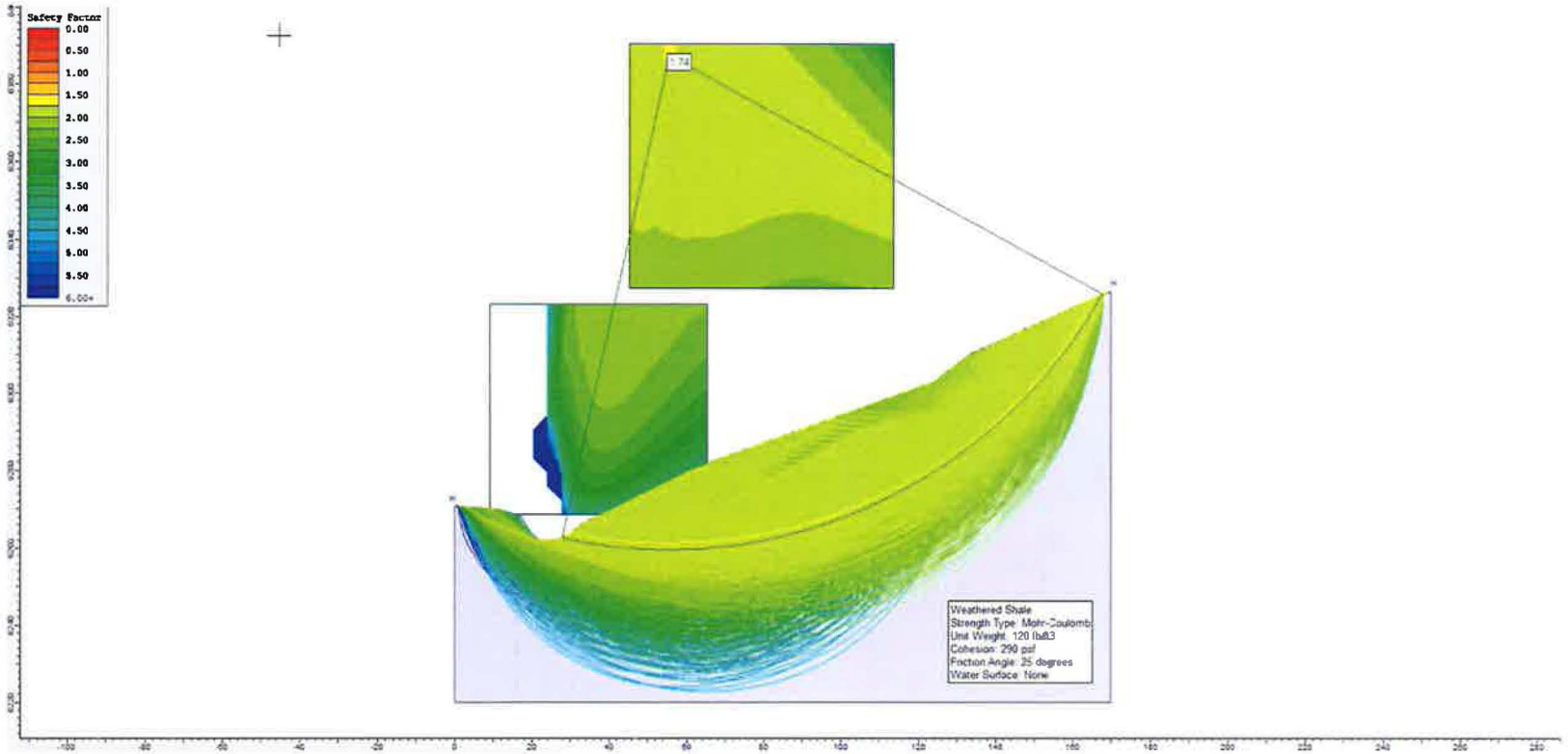

Figure B-1: Slide Geometry and Output for Analysis of Haul Road at Critical Section – Post-Reclamation

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APPENDIX 5-4

Justification for Removal of the Sedimentation Pond at the Beginning of Site Reclamation

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APPENDIX 5-4

JUSTIFICATION FOR REMOVAL OF SEDIMENTATION POND AT THE BEGINNING OF SITE RECLAMATION

Background

The Utah Coal Regulatory Program specifies that sedimentation ponds be retained for a period of at least 2 years after the last augmented seeding following the initiation of reclamation activities (see R645-301-356.300 and R645-301-763). However, in the case of the Deer Creek waste rock site, this rule would prevent final reclamation and/or cause re-disturbance of at least 6.01 acres of the 14.69-acre total disturbed area following the waiting period after the last augmented seeding. Thus, at least 41% of the disturbed area would remain un-reclaimed and/or require re-disturbance following the initiation of reclamation activities. In reality, this percentage of un-reclaimed or re-disturbed land would likely be much greater in order to maintain site access and equipment operation efficiencies. Given this situation, BRC Wellington, LLC ("BRCW") has proposed to not retain the sedimentation pond as required by the regulations but rather to remove the sedimentation pond, regrade and reclaim the waste rock site, construct the final reclamation channels, and reclaim the site access road as one efficient operation.

In lieu of the sedimentation pond, sediment control will be provided during reclamation using the proven surface-roughening technique known as deep gouging. This method has been successfully applied at several mine sites in Utah and was a major reason why the U.S. Office of Surface Mining Reclamation and Enforcement ("OSM") awarded Castle Gate Mining Company with the 2003 Excellence in Surface Coal Mining and Reclamation National Award. In describing this method, "The Practical Guide to Reclamation in Utah" prepared by the Utah Division of Oil, Gas and Mining,[1] noted that the technique involves gouging of the regraded surface "in a random and overlapping pattern, making it impossible for water to flow down slope." The gouges retain precipitation, thereby precluding runoff and the generation of down-slope sediment. Gouging and the associated mulching also create a microenvironment that encourages rapid germination of seeds, thereby greatly enhancing revegetation success.

BRCW has proposed removal of the existing sedimentation pond when site regrading and gouging reached that area since (1) gouging will trap all precipitation and associated runoff, thereby making the pond unnecessary and (2) if the pond was to remain in place during reclamation, re-entry into the site to remove the pond and construct the final reclamation channels will cause substantial disturbance to the area. The purpose of this appendix is to show that removal of the sedimentation pond and implementation of deep gouging represents the Best Technology Currently Available for reclamation of the Deer Creek waste rock site.

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[1] Wright, M.A. and S. White (eds.). n.d. The Practical Guide to Reclamation in Utah. Utah Division of Oil, Gas and Mining. Salt Lake City, Utah. Downloaded from https://fs.ogm.utah.gov/pub/MINES/Coal_Related/RecMan/Reclamation_Manual.pdf.

Deep Gouging Design Standard

The design standard for deep gouging is generally as stated in DOGM's reclamation guide.[1] The gouges are constructed using a trackhoe to excavate multiple shallow pits into the regraded, topsoiled, and mulched soil. Soil from each excavated pit is placed around the rim of the pit. Field experience has indicated that individual pits have approximate surface diameters of 3 to 6 feet and approximate depths of 1.5 to 3 feet. Gouges are constructed in a random, overlapping pattern. Additional mulch is then added, together with a tackifier, during revegetation of the site. When completed, the area is difficult to walk across.

Potential Inflow Volumes

Based on the formula for a truncated sphere, a uniform gouge with a surface diameter of 6 feet and a depth of 3 feet will have a volume of 56.5 cubic feet. Similarly, a uniform gouge with a surface area of 3 feet and a depth of 1.5 feet will have a volume of 7.1 cubic feet. This represents the typical, anticipated volume range of gouges installed during reclamation of a site. Since the gouges are designed to retain all water, no overland flow will occur within the gouged area.

Data obtained from the National Weather Service Hydrometeorological Design Studies Center web site indicates that the 100-year, 24-hour storm produces 2.65 inches of precipitation[2] (see Attachment A).[3] With a top surface area of 28.3 square feet, the 6-foot diameter deep gouge will capture 6.2 cubic feet of direct precipitation (assuming no infiltration). The smallest of the typical gouges (with a top diameter of 3 feet and a surface area of 7.1 square feet) will capture 1.6 cubic feet of direct precipitation during the same event (again assuming no infiltration). These volumes represent 11.0% and 22.1% of the capacity of the 6-foot and 3-foot diameter gouges, respectively (see Attachment B).

As a point of comparison, data provided in Attachment A indicate that the estimated precipitation depth resulting from the 1000-year, 24-hour event is 3.47 inches. The typical 6-foot and 3-foot diameter gouges would capture 8.2 cubic feet and 2.0 cubic feet of direct precipitation, respectively, from this event, representing 14.5% and 28.9%, respectively, of the capacity of the two typical gouge sizes (see Attachment B). Thus, it is reasonable to conclude that the typical gouges will have a sufficient volume to retain all direct precipitation without discharging.

As indicated previously, soil excavated during gouging of the soil is placed around the perimeter of the resulting pit. Thus, overland flow from the undisturbed area immediately adjacent to the reclaimed area will generally be captured behind the uppermost gouges. In the

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[2] National Weather Service Hydrometeorological Design Studies Center data base accessed at http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ut.

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[3] Note that the precipitation depths obtained from the National Weather Service web site are less than those used for design of the reclamation channels at the site. This is due to updated data provided on the NWS web site when compared with the original site design data. As a result, the reclamation channels (which used the original site design data for the sake of consistency) are designed with a significant safety factor.

event that this does not occur, this overland flow would discharge into the uppermost gouges at the boundary between the reclaimed and undisturbed areas.

The quantity of overland flow that could discharge from the undisturbed area into an uppermost gouge was estimated by multiplying the overland flow quantity by the contributing area. The depth of runoff was calculated for the 10-year, 24-hour and 100-year, 24-hour precipitation events using an estimated curve number of 67 for the undisturbed area (see Attachment C). The contributing area to an uppermost gouge was estimated based on typical gouge diameters of 3 to 6 feet and overland flow lengths of 25 to 50 feet (the typical minimum and maximum flow distances before channelization, based on field observation).

As indicated in Attachment C, the estimated maximum runoff into a large gouge is 10.5 cubic feet from the 100-year, 24-hour storm. Together with direct precipitation of 6.2 cubic feet, this represents a volume of 16.7 cubic feet of water in a gouge with a capacity of 56.5 cubic feet (i.e., 30% of the large gouge capacity). The total inflow from a 10-year, 24-hour precipitation event would be less.

The maximum potential inflow into a small gouge is 5.3 cubic feet from the 100-year, 24-hour storm. Together with direct precipitation of 1.6 cubic feet, this represents a volume of 6.9 cubic feet of water in a gouge with a capacity of 7.1 cubic feet (i.e., 97% of the small gouge capacity). The total inflow from a 10-year, 24-hour precipitation event would be less. Thus, even in the case of a 100-year, 24-hour precipitation event, the gouges will have a sufficient capacity to retain overland flow from the adjacent undisturbed area without discharging.

Effectiveness of Deep Gouging for Reducing Soil Erosion

Deep gouging has been used as an effective coal-mine reclamation technique in Carbon and Emery Counties, Utah since the late 1990s. Field observations of the reclaimed Willow Creek Mine and Star Point Mine sites, as well as other locations in the region, have verified that deep gouging is effective at capturing water, increasing vegetative cover, and minimizing erosion. Even after significant thunderstorms, no breaches of the gouges have been observed by EarthFax personnel.

Kapolka[4] studied revegetation success and soil loss in a reclaimed area of a talc mine in southwestern Montana at an elevation of about 8,500 feet. She evaluated uniform slope gradients ranging from 25% to 50% and topsoil thickness ranging from 0 to 18 inches. She concluded that "soil losses the first year following reclamation were higher for all slope gradients" that she evaluated. As a result, she recommended that a "support practice" should be implemented during initial site reclamation to reduce the observed erosion. Deep gouging is such a support practice.

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[4] Kapolka, N.M 1999. Effect of Slope Gradient and Plant Cover on Soil Loss on Reconstructed High Altitude Slopes. Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Land Rehabilitation. Montana State University. Bozeman, MT.

Winking[5] expanded on the work of Kapolka[4] by examining the effects of "pitting" (among other practices) on soil loss from the same reclaimed site investigated by Kapolka. The pits evaluated by Winking were hand dug with individual volumes of approximately 900 cubic centimeters (0.03 cubic foot). The pits were staggered in a checkerboard pattern with alternating rows of two and three pits and a distance between pits of about 11 feet. Notwithstanding the limited volume and large spatial extent of Winking's pits relative to standard deep gouging practice, Winking concluded that pitting of the soil surface was an effective erosion control practice, significantly reducing erosion by a factor of 4 to 8 compared with topsoiled areas that had not been pitted. She also concluded that pitting substantially decreased rill formation compared with all other treatments that were evaluated (topsoil alone, topsoil with slash barriers, topsoil with arbuscular mycorrhizal inoculation, and an undisturbed location without additional treatment). This research verifies the empirical evidence gained from several years of reclaimed-site observations in the Carbon/Emery area.

Predicted Sediment In-fill Rates

The predicted rate of soil loss from proposed gouges at the reclaimed Deer Creek waste rock site was calculated using the Revised Universal Soil Loss Equation. The calculations presented in Attachment D are based on gouging of a reclaimed surface after backfilling, grading, and mulching. The largest typical gouge (with a surface diameter of 6 feet and a depth of 3 feet) was used to provide the greatest slope length. An average post-reclamation sediment yield of 0.68 ton/ac/yr was assumed, as shown in Appendix 7-5. The weight of eroded sediment was assumed to be 100 lb/ft^3.

Under these assumptions, a period of over 3,000 years will be required for a small gouge to fill with sediment and more than 9,000 years will be required for a large gouge to fill with sediment (see Attachment D). At these long time frames, vegetative growth will not be hampered and in-filling of gouges with sediment is not of concern.

Agency Support of Deep Gouging

As indicated previously, "The Practical Guide to Reclamation in Utah" prepared by the Utah Division of Oil, Gas and Mining, endorses deep gouging in its Technical Sheet entitled "Extreme Surface Roughening." The guide indicates that this approach is used to "intercept and trap sediment on a microscale." It further notes that "roughening also collects moisture, which improves vegetation establishment and consequently prevents erosion." The guide notes that the method is "*highly* recommended for moderate to steep slopes (up to 1h 1½v) but is also useful for flat or gently sloping areas with erosive soils and arid climates" (emphasis added). The reclamation approach proposed by BRCW implements these recommendations.

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[5] Winking, S.R. 2002. Effect of Mechanical and Biological Enhancements on Erosion at High Elevation Disturbed Lands. Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Land Rehabilitation. Montana State University. Bozeman, MT.

OSM has also recognized the value of gouging in their reclamation training manual.[6] This manual states that "pitting, gouging, and contouring are acceptable methods for use on mined lands. The object of these methods is to increase runoff from the water-collecting zone and increase infiltration in the plant-growing zone." In a subsequent reclamation handbook, OSM[7] indicated that sites should be graded "to retain the maximum moisture onsite with minimum delivery of runoff from the hillslope. . . . Leaving the regraded surface in a roughened condition will enhance its water retention capabilities. . . . Reclamation success has been achieved with 'pitting', which is a mechanical means of constructing actual pits or divots with the topsoiled surface." The reclamation approach proposed by BRCW implements these recommendations.

The U.S. Forest Service evaluated various options for improving the success of revegetation efforts in the semi-arid Intermountain/Rocky Mountain region.[8] They concluded that "where available at reasonable cost, use of hay is recommended to increase moisture-holding capacity and improve seedling establishment. Surface configurations such as gouging (pitting) and contour furrowing should also be used to retain precipitation in the form of snow or rain on reconstructed area." The reclamation approach proposed by BRCW (mulching and deep gouging) implements these recommendations.

The U.S. Congress, Office of Technology Assessment produced a report in 1986 that evaluated the state-of-the-art of mine-land reclamation in the West.[9] That office concluded that sedimentation ponds may not represent the Best Technology Currently Available for controlling sediment during reclamation of land in the Western United States. Their report states:

> "Sedimentation ponds are expensive to build and maintain, and they increase the amount of land that must be disturbed during mining and reclamation. The water discharged from sedimentation ponds also is unnaturally clear and therefore can result in erosion and channel degradation downstream in ephemeral streams, which have a naturally high sediment content. Moreover, the cumulative effect of water storage in sediment control ponds at multiple mines in one area can be a significant loss of water— the West's most scarce resource—to downstream users.
>
> "Alternate means of maintaining sediment production at or below the level produced from undisturbed terrain are available, including preventive measures that retard the velocity and reduce the quantity of runoff, thus reducing erosion rates, and remedial designs that reduce erosion by avoiding sensitive areas and increased sediment

---

[6] Vogel, W.G. 1987. A Manual for Training Reclamation Inspectors in the Fundamentals of Soils and Revegetation. Prepared for the Office of Surface Mining and Enforcement by the USDA Forest Service, Northeastern Forest Experiment Station. Berea, KY.

[7] Ferris, F.K. et al. 1996. Handbook of Western Reclamation Techniques. Office of Surface Mining Reclamation and Enforcement, Office of Technology Transfer, Western Regional Coordinating Center. Denver, CO.

[8] Frischknecht, N.C. and R.B. Ferguson. 1979. Revegetating Processed Oil Shale and Coal Spoils on Semi-Arid Lands: Interim Report. USDA IAG No. DE-E764. USDA Forest Service Intermountain Forest and Range Experiment State. Provo, Utah. EPA-600/7-79-068. U.S. Environmental Protection Agency, Industrial Environmental Research Laboratory. Cincinnati, Ohio.

[9] U.S. Congress, Office of Technology Assessment. 1986. Western Surface Mine Permitting and Reclamation. OTA-E-279. Washington, D.C.

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deposition. In addition to mitigating the impacts of sedimentation ponds noted above, the alternate control methods can aid revegetation by reducing runoff and thus increasing soil moisture, and by reducing erosion. They also eliminate the risk of sediment pond dam failure. Such alternate sediment control techniques are considered proven technology and have been implemented successfully in agriculture, highway construction, and other land-disturbing activities. . . .

"There are numerous methods of preparing the redressed topsoil for seeding and planting, and of preventing erosion. These include contour furrowing, ripping on the contour, *surface pitting*, disking, terracing, and mulching." (Emphasis added)

The reclamation approach proposed by BRCW (mulching and deep gouging) follows this course of action.

In 2002, The U.S. Environmental Protection Agency amended the effluent limitations for the coal mining source category and created a new Western Alkaline Coal Mining Subcategory.[10] This new subcategory was "created primarily because of the negative impacts caused by the predominant use of sedimentation ponds necessary to meet" the former effluent limitations. The new EPA rule specifically amended 40 CFR 434, which contains the effluent limitations that must be met under the DOGM rules promulgated at R645-301-751. The Federal Register announcement stated that "EPA has determined that the predominant use of sedimentation ponds in order to meet the Subpart E numeric standards for settleable solids have caused negative impacts in arid and semiarid environments." Subpart E of the regulations is applicable to "Post-Mining Areas" (i.e., including areas that are undergoing reclamation).

The 2002 Federal Register announcement indicated that "ponds are one in a suite of BMPs [Best Management Practices] that a mine operator may install in order to meet reclamation standards. However, ponds may not be necessary in all circumstances and the use of other BMPs such as check dams, vegetation, silt fences, and other construction practices can be equally protective of the environmental." The amended rules were intended to allow "permitting authorities and mining operators sufficient flexibility to use the appropriate BMPs necessary to control sediment and protect water quality" in the Western US.

The Federal Register announcement further states: "EPA determined that BPT [Best Practicable Control Technology Currently Available] for the Western Coal Mining Subcategory consists of designing and implementing BMPs to maintain average annual sediment yield equal to or below pre-mining, undisturbed conditions. . . . The appropriate goal for reclamation and discharges from post-mined lands should be to mimic conditions that were present prior to mining activities. . . . EPA is establishing BPT that consists of designing and implementing BMPs that are projected to maintain the average annual sediment yield equal to or below pre-mined, undisturbed conditions. This would ensure that undisturbed conditions are maintained." The reclamation approach proposed by BRCW (mulching and deep gouging) achieves these goals as indicated by the calculations presented in Appendix 7-5.

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[10] Federal Register, Vol. 67, No. 15. January 23, 2002. pp. 3370-3410.

Conclusions

The following conclusions have been reached based on the above evaluations:

1. Retention of the sedimentation pond following initiation of the Deer Creek waste rock site will prevent the timely reclamation and/or require the re-disturbance of a significant portion of the site if the operator is to be in strict compliance with the requirements of R645-301-356.300 and R645-301-763.
2. Deep gouging is effective at minimizing soil loss from reclaimed mine sites. When properly installed, the gouges retain all precipitation, thereby precluding runoff and the generation of down-slope sediment. As a result, deep gouging controls erosion at the source and enhances revegetation.
3. Typical gouges with approximate surface diameters of 3 to 6 feet and approximate depths of 1.5 to 3 feet, constructed in a random, overlapping pattern, are effective at retaining all direct precipitation from storm events with return periods of in excess of 100 years and all runoff from uphill, undisturbed areas resulting from similar events.
4. The volume of typical indentations formed by deep gouging is sufficient that a period of at least 3,000 years is required before individual indentations will fill with sediment. During this time, vegetation will continue to stabilize the gouges as they fill, thus resulting in an erosionally-stable site long before the gouges fill with sediment.

Given these factors, mulching and deep gouging of the Deer Creek waste rock site is considered to be the Best Technology Currently Available.

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ATTACHMENT A

Depth-Duration-Frequency Data for the
Deer Creek Waste Rock Site

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EarthFax Engineering Group, LLC

NOAA Atlas 14, Volume 1, Version 5
Location name: Huntington, Utah, US*
Latitude: 39.3802°, Longitude: -111.0618°
Elevation: 6329 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.125 (0.108-0.148)	0.161 (0.140-0.190)	0.222 (0.191-0.261)	0.275 (0.235-0.326)	0.359 (0.298-0.425)	0.433 (0.352-0.514)	0.519 (0.413-0.618)	0.618 (0.478-0.743)	0.775 (0.572-0.949)	0.917 (0.653-1.14)
10-min	0.190 (0.165-0.225)	0.245 (0.213-0.290)	0.338 (0.291-0.398)	0.419 (0.358-0.495)	0.546 (0.455-0.647)	0.659 (0.537-0.782)	0.790 (0.629-0.941)	0.940 (0.727-1.13)	1.18 (0.871-1.45)	1.40 (0.993-1.74)
15-min	0.236 (0.205-0.279)	0.303 (0.264-0.359)	0.419 (0.360-0.493)	0.519 (0.444-0.614)	0.677 (0.563-0.802)	0.817 (0.665-0.970)	0.979 (0.780-1.17)	1.17 (0.901-1.40)	1.46 (1.08-1.79)	1.73 (1.23-2.16)
30-min	0.318 (0.276-0.376)	0.408 (0.355-0.484)	0.564 (0.485-0.664)	0.700 (0.598-0.827)	0.912 (0.759-1.08)	1.10 (0.896-1.31)	1.32 (1.05-1.57)	1.57 (1.21-1.89)	1.97 (1.45-2.41)	2.33 (1.66-2.90)
60-min	0.393 (0.341-0.465)	0.505 (0.440-0.599)	0.698 (0.601-0.822)	0.866 (0.740-1.02)	1.13 (0.939-1.34)	1.36 (1.11-1.62)	1.63 (1.30-1.95)	1.94 (1.50-2.34)	2.44 (1.80-2.99)	2.88 (2.05-3.59)
2-hr	0.475 (0.416-0.554)	0.601 (0.525-0.701)	0.803 (0.698-0.935)	0.985 (0.848-1.15)	1.27 (1.07-1.48)	1.53 (1.26-1.79)	1.82 (1.47-2.16)	2.17 (1.69-2.58)	2.72 (2.03-3.31)	3.22 (2.32-3.99)
3-hr	0.532 (0.471-0.611)	0.668 (0.590-0.769)	0.864 (0.762-0.995)	1.04 (0.911-1.20)	1.32 (1.14-1.52)	1.56 (1.31-1.81)	1.85 (1.53-2.16)	2.19 (1.77-2.59)	2.75 (2.13-3.31)	3.25 (2.44-4.03)
6-hr	0.677 (0.606-0.763)	0.840 (0.756-0.950)	1.05 (0.939-1.18)	1.23 (1.09-1.39)	1.48 (1.30-1.68)	1.71 (1.48-1.94)	1.98 (1.69-2.27)	2.29 (1.92-2.66)	2.84 (2.32-3.36)	3.34 (2.66-4.07)
12-hr	0.835 (0.758-0.926)	1.03 (0.939-1.15)	1.27 (1.14-1.41)	1.46 (1.31-1.63)	1.73 (1.54-1.93)	1.94 (1.71-2.18)	2.17 (1.89-2.45)	2.45 (2.11-2.80)	2.97 (2.51-3.43)	3.46 (2.88-4.10)
24-hr	1.07 (0.970-1.19)	1.33 (1.20-1.48)	1.62 (1.47-1.80)	1.85 (1.67-2.06)	2.17 (1.94-2.41)	2.41 (2.15-2.68)	2.65 (2.35-2.96)	2.90 (2.54-3.25)	3.22 (2.79-3.64)	3.47 (2.97-4.14)
2-day	1.24 (1.13-1.38)	1.54 (1.40-1.71)	1.88 (1.71-2.08)	2.16 (1.95-2.39)	2.53 (2.26-2.80)	2.81 (2.50-3.12)	3.10 (2.74-3.46)	3.40 (2.97-3.80)	3.79 (3.26-4.27)	4.09 (3.48-4.65)
3-day	1.36 (1.24-1.52)	1.69 (1.53-1.88)	2.07 (1.87-2.30)	2.37 (2.14-2.63)	2.78 (2.49-3.09)	3.10 (2.75-3.45)	3.42 (3.02-3.82)	3.75 (3.27-4.20)	4.19 (3.59-4.73)	4.53 (3.84-5.15)
4-day	1.48 (1.34-1.66)	1.84 (1.67-2.05)	2.25 (2.04-2.51)	2.58 (2.33-2.88)	3.04 (2.71-3.38)	3.38 (3.00-3.77)	3.74 (3.29-4.18)	4.10 (3.57-4.60)	4.59 (3.93-5.10)	4.96 (4.19-5.65)
7-day	1.72 (1.56-1.92)	2.14 (1.94-2.39)	2.63 (2.37-2.92)	3.02 (2.71-3.35)	3.55 (3.17-3.94)	3.96 (3.51-4.41)	4.38 (3.85-4.90)	4.80 (4.18-5.40)	5.37 (4.60-6.10)	5.81 (4.92-6.66)
10-day	1.96 (1.78-2.17)	2.44 (2.21-2.71)	2.99 (2.71-3.31)	3.43 (3.10-3.79)	4.01 (3.60-4.44)	4.46 (3.97-4.94)	4.90 (4.34-5.46)	5.35 (4.69-5.98)	5.95 (5.14-6.70)	6.40 (5.47-7.28)
20-day	2.50 (2.27-2.79)	3.13 (2.83-3.49)	3.87 (3.49-4.31)	4.45 (4.00-4.95)	5.22 (4.66-5.81)	5.80 (5.14-6.48)	6.40 (5.63-7.16)	7.00 (6.09-7.86)	7.79 (6.69-8.82)	8.39 (7.12-9.56)
30-day	3.02 (2.73-3.35)	3.76 (3.41-4.17)	4.60 (4.16-5.10)	5.25 (4.74-5.82)	6.10 (5.47-6.77)	6.74 (6.01-7.48)	7.37 (6.54-8.21)	7.99 (7.02-8.94)	8.80 (7.64-9.91)	9.40 (8.07-10.7)
45-day	3.68 (3.35-4.08)	4.59 (4.17-5.08)	5.62 (5.10-6.22)	6.42 (5.80-7.09)	7.46 (6.70-8.25)	8.24 (7.35-9.12)	9.01 (7.99-10.0)	9.78 (8.61-10.9)	10.8 (9.37-12.1)	11.5 (9.92-13.0)
60-day	4.30 (3.90-4.77)	5.38 (4.88-5.95)	6.60 (5.97-7.29)	7.53 (6.80-8.32)	8.74 (7.85-9.68)	9.65 (8.61-10.7)	10.5 (9.34-11.7)	11.4 (10.0-12.8)	12.6 (10.9-14.2)	13.4 (11.5-15.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

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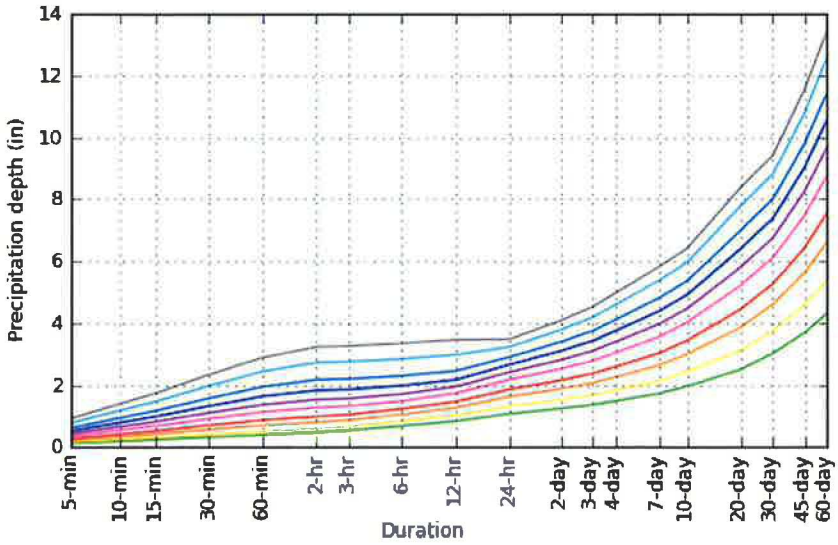
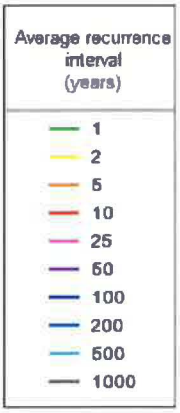
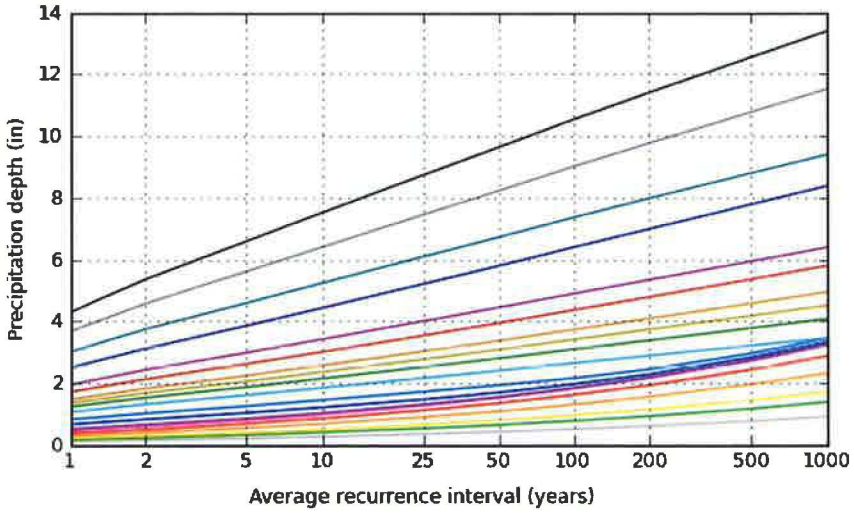
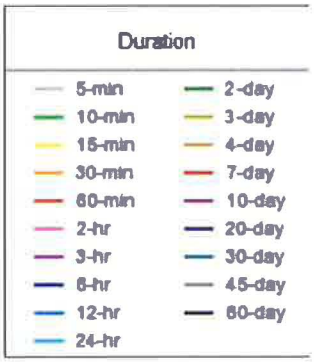
PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.3802°, Longitude: -111.0618°









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Maps & aerials

Small scale terrain

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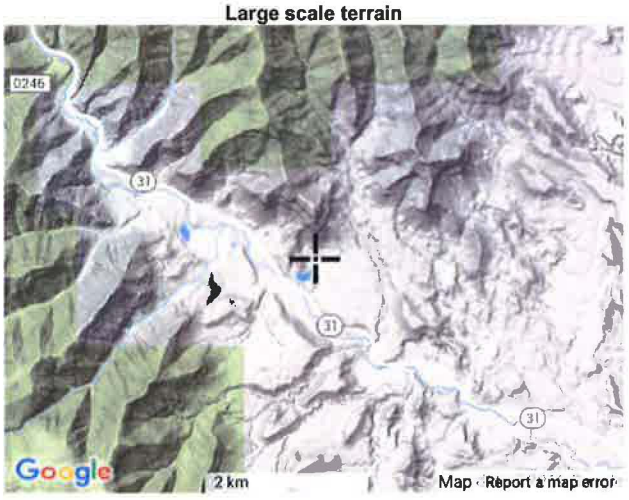
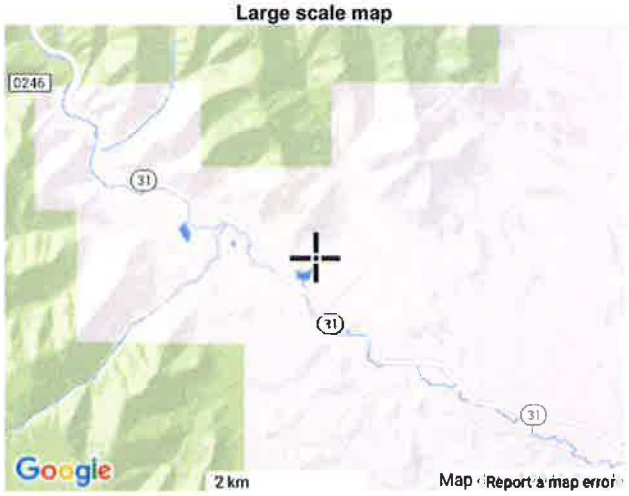
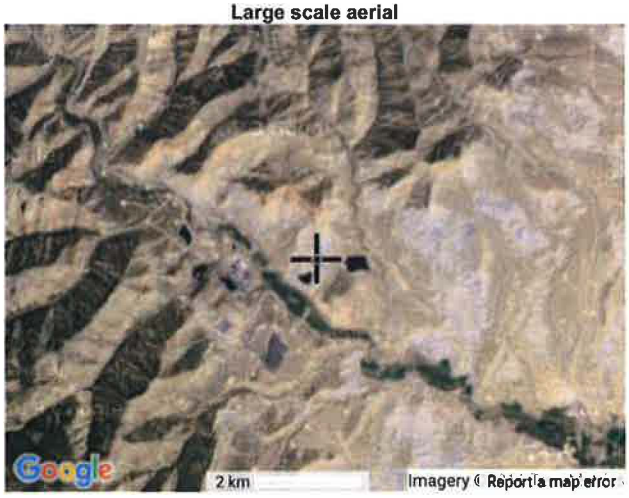
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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ATTACHMENT B

Calculation of Direct Precipitation Volumes
Into Individual Gouges

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EarthFax Engineering Group, LLC

Percent of Typical Gouge Volume Filled by Direct Precipitation
Deer Creek Waste Rock Site

Parameter	Large Gouge		Small Gouge	
	100-yr, 24-hr Precip	1000-yr, 24-hr Precip	100-yr, 24-hr Precip	1000-yr, 24-hr Precip
Gouge diameter =	6 ft	6 ft	3 ft	3 ft
Gouge depth =	3 ft	3 ft	1.5 ft	1.5 ft
Gouge area =	28.3 sf	28.3 sf	7.1 sf	7.1 sf
Precip depth =	2.65 in	3.47 in	2.65 in	3.47 in
Precip volume =	6.24 cf	8.18 cf	1.56 cf	2.04 cf
Gouge volume =	56.5 cf	56.5 cf	7.1 cf	7.1 cf
Percent of capacity =	11.0 %	14.5 %	22.1 %	28.9 %

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ATTACHMENT C

Calculation of Overland Flow Volumes
Into Individual Gouges

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Estimated Overland Flow Volume into Uppermost Gouges
Deer Creek Waste Rock Site

Curve number =	67	S = 4.93
Min. overland flow length =	25 ft	
Max. overland flow length =	50 ft	
Typical max. gouge dia. =	6 ft	
Typical min. gouge dia. =	3 ft	
Max. contributing area =	300 sq. ft.	
Min. contributing area =	75 sq. ft.	
10-yr, 24-hr precip =	1.85 in	
Runoff from the event =	0.13 in	
100-yr, 24-hr precip =	2.65 in	
Runoff from the event =	0.42 in	

Calculations based on 10-yr, 24-hr precip event:

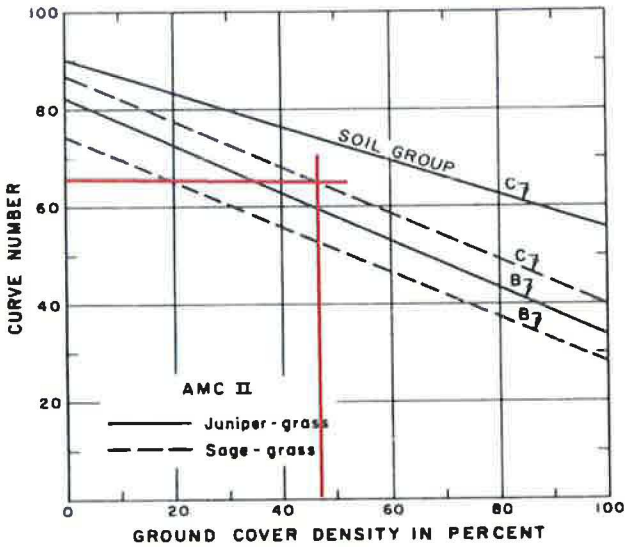
Max runoff to uppermost large gouge =	3.2 cubic ft
Max runoff to uppermost small gouge =	1.6 cubic ft
Min runoff to uppermost large gouge =	1.6 cubic ft
Min runoff to uppermost small gouge =	0.8 cubic ft

Calculations based on 100-yr, 24-hr precip event:

Max runoff to uppermost large gouge =	10.5 cubic ft
Max runoff to uppermost small gouge =	5.3 cubic ft
Avg runoff to uppermost large gouge =	5.3 cubic ft
Avg runoff to uppermost small gouge =	0.8 cubic ft

Note:

1. Curve number based on ground cover density of 47% (39% understory + 8% litter) in the site reference area as indicated by Mt. Nebo Scientific in their 1987 vegetation monitoring report (see Attachment 3-1). Data provided in Attachment 2-1 indicate that the Hydrologic Soil Group of the Gerst and Strych soils is "D" and "A", respectively. The analysis was based on a Hydrologic Soil Group of "C". See the figure below from NEH, Part 630, Hydrology.



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ATTACHMENT D

Results of Sediment Yield Calculations

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Time Required to Fill Gouges With Sediment

Deer Creek Waste Rock Site

Max post-reclamation sediment yield =	0.68	t/ac/yr	(see Appendix 7-5)
Assumed sediment unit weight =	100	lb/cf	
Large gouge area =	28.3	sf	
Large gouge volume =	56.5	cf	
Time required to fill large gouge =	6,395	yr	
Small gouge area =	7.1	sf	
Small gouge volume =	7.1	cf	
Time required to fill small gouge =	3,203	yr	

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CHAPTER 6
GEOLOGY

6.10 Introduction

This chapter presents a description of the geologic resources in the area of the Deer Creek waste rock site ("Deer Creek site" or the "site"). Since no coal is being mined and no exploration activities are being conducted in the permit area, this chapter includes only general geologic information compiled from previously published documents.

6.1.1 General Requirements

The geologic resources in the Deer Creek site are discussed in Sections 6.2.1 through 6.2.7 of this chapter.

6.1.2 Certification

All maps, plans, and cross-sections presented in this chapter, as required by the Utah Administrative Rules, have been certified by a professional engineer.

6.20 Environmental Description

This section presents a description of the geologic resources in the area of the Deer Creek site.

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6.2.1 General Requirements

This section presents information concerning the regional and site-specific geology of the Deer Creek site.

6.2.2 Cross Sections, Maps and Plans

Figure 6-1 presents a map and generalized stratigraphic section of the geology of the site area. The data used to prepare Figure 6-1 were obtained from Witkind et al. (1987). Since there no coal mining or exploration will occur at the site, coal seam data such as outcrop lines, bedding plane orientations, and drillhole information are not shown.

No oil or gas wells exist within the permit area.

6.2.3 Geologic Determinations

Since no mining will occur at the site, no have been collected concerning the acid- or toxic-forming characteristics of the site strata. However, Energy West evaluated data collected from over 130 outcrop and core samples to assess the potential acid- or toxic-forming characteristics of the waste rock that was disposed of at the site. These data are summarized in Appendix 6-1. Comparison of these data with guidelines published by the Division of Oil, Gas and Mining[1] indicates the following:

- The pH of the waste rock is moderately alkaline and should not hinder reclamation.
- The electrical conductivity of the waste rock is less than 4 mS/cm and should, therefore, not hinder reclamation.
- The sodium adsorption ratio of the waste rock is generally less than 4, indicating that this factor should not hinder site reclamation.
- The boron concentration of the waste rock is less than 5 m/kg, indicating that concentrations of this element should not hinder site reclamation.

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Energy West submitted one composite sample for analyses of soluble selenium and calcium carbonate content. The soluble selenium concentration of the sample was 0.098 mg/kg,

[1] Utah Division of Oil, Gas and Mining. 2008. Guidelines for Management of Topsoil and Overburden. Downloaded from https://fs.ogm.utah.gov/pub/MINES/Coal_Related/soilsguide.pdf on 22 Jan 2015.

which is an acceptable concentration according to the Division guideline. The calcium carbonate concentration of the sample was 26.3%. This, together with the alkaline nature of the rock, suggests that the acid/base potential of the waste rock is acceptable. These data, taken together, indicate that the waste rock from which the coal will be recovered is neither acid- nor toxic-forming.

The geologic information required by DOGM to make a determination as to whether the reclamation plan can be accomplished is presented in Section 6.2.4. Since no mining will occur at the site, no subsidence control program has been prepared.

6.2.4 Geologic Information

6.2.4.1 Regional Setting

The DCRW site is located near the mouth of Huntington Canyon, about 6 miles northwest of the town of Huntington, Utah. The site is located on the southern flank of Gentry Mountain just south of Wild Horse Ridge. Rocks exposed in the area are marine-derived mudstones in the lower portion of the Masuk Member of the Mancos Shale. The Masuk Shale on the bench which adjoins the site on the east and west is covered by a 5- to 20- foot thick layer of terrace gravel of Quaternary age. North-south trending normal faults have disrupted the strata in the region. However, no faults are known to exist within the permit area.

Stratigraphy. The oldest rocks exposed in the region are part of the marine Mancos sequence deposited in Late Cretaceous time. This formation contains several alternating units of off-shore marine mudstones near-shore marine sandstones.

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The upper unit of the Mancos is the Masuk Member, which underlies the surface of the site. The Masuk Member consists of shale and shaly siltstone that is thin to medium bedded with a few thin interlayered sandstone beds (Witkind et al., 1987). The Masuk Member is generally

devoid of significant water.

The benches on the west and east sides of the permit area are covered by a Quaternary pediment mantle. These materials are highly variable, of fluvial origin, and consist of a poorly bedded mixture of silt, sand, pebbles, cobbles, and boulders derived from adjacent uplands (Witkind et al., 1987). In the vicinity of the permit areas, these materials are generally 5 to 20 feet thick.

Structure. The strata in the permit area dip west-northwest at an angle of 2 to 3 degrees into the Straight Canyon Syncline. The nearest known fault to this area plotted by Witkind et al. (1987) is located approximately 2 miles to the west. No faults are known to exist in the permit area. Regionally, the strata contain vertical joints trending in both a northwest and northeast direction. It is hard to identify jointing in the weathered Masuk shale outcrops, but in fresh cuts the joints appear to be wide spaced. Very limited amounts of ground water migrate down these fractures because the clays present in the rock swell when in contact with water, thus sealing the fractures.

Surface and Groundwater Impact. Potential surface and groundwater impacts are discussed in Chapter 7 of this application.

6.2.4.2 Test Boring and Drillhole Data (overburden removed)

No mining or coal exploration will occur in the permit area.

6.2.4.3 Test Boring and Drillhole Data (overburden not removed)

No mining or coal exploration will occur in the permit area.

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6.2.5 Additional Geologic Information

It is not anticipated that any additional geologic data will need to be collected at this site.

6.2.6 Sampling Waivers

BRC Wellington does not request a sampling waiver for this site.

6.2.7 Description of the Overburden Thickness and Lithology

No mining or coal exploration will occur in the permit area.

6.30 Operation Plan

6.3.1 Casing and Sealing of Exploration Holes

No exploration holes will be drilled in the permit area.

6.3.2 Subsidence Monitoring

Since there will be no mining or exploration at the Deer Creek site, subsidence will not occur as a result of site operations. Therefore, a subsidence monitoring program is not required.

6.40 Performance Standards

6.4.1 Exploration and Drillholes

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No coal exploration will occur in the permit area.

6.4.2 Monuments and Surface Markers of Subsidence Monitoring Points

Since there will be no mining or exploration at the Deer Creek site, subsidence will not occur as a result of existing site operations. Therefore, no subsidence monuments or surface markers are required.

REFERENCES

Witkind, I.J., M.P. Weiss, and T.L. Brown. 1987. Geologic Map of the Manti 30' x 60' Quadrangle, Carbon, Emery, Juab, Sanpete, and Sevier Counties, Utah. U.S. Geological Survey Miscellaneous Map Series I-1631. U.S. Geological Survey. Denver, Colorado.

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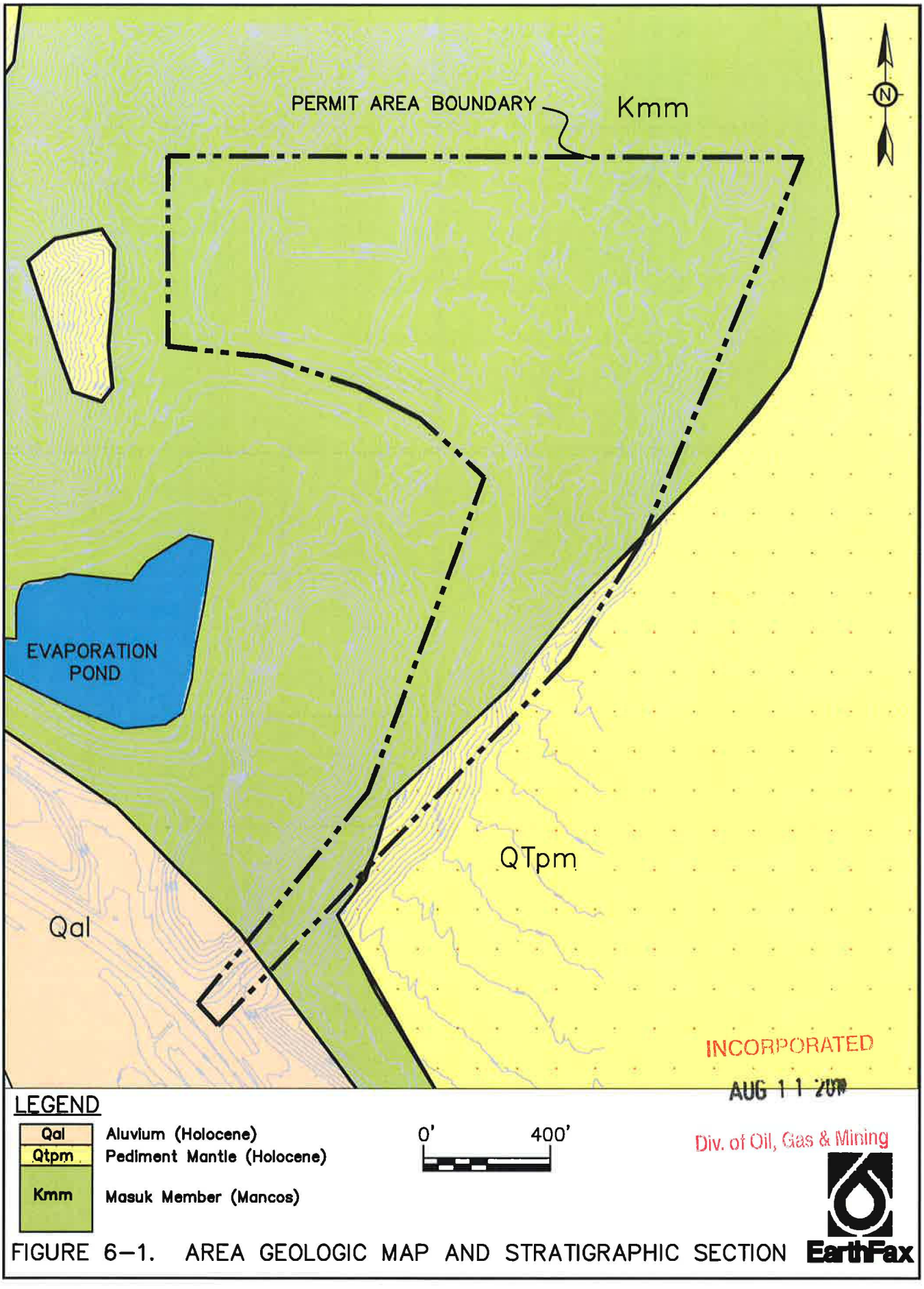

FIGURE 6–1. AREA GEOLOGIC MAP AND STRATIGRAPHIC SECTION

G:\UC14\ Deer Creek waste rock\Draft MRP\DWG\FIGURE 6-1.dwg, 1/28/2015 3:46:44 PM

APPENDIX 6-1

Summary of Prior Waste Rock Analyses

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WASTE ROCK CHEMICAL AND PHYSICAL PROPERTIES

Lithology	Chemical Test	Physical Test	CHEMICAL TESTS Ca Meq/L	Mg Meq/L	Na Meq/L	^{1}SAR	Fe ppm	Zn ppm	SO_4 ppm	Mo ppm	B ppm	pH Paste	E.C.^{2} mmhos/cm	PHYSICAL TESTS Sat. %	Pyrite FeS_2	Sand %	Silt %	Clay %	Rock Texture
Blackhawk Formation:																			
Sandstone:	26	2																	~~Sandy~~
Mean			4.37	8.18	2.13	1.05	8874	11.47	409.6	.1	.06	8.0	1.55	21.7	–	84.5	11.0	4.5	Loamy sand
S.D.			3.91	5.13	1.08	0.69	6672	9.7	353.1	0.0	.06	0.96	0.89	3.36	–	0.71	1.41	2.12	
Siltstone:	24	5																	Sandy
Mean			3.06	6.24	2.30	1.69	14512.88	38.26	464.41	.1	0.18	7.88	1.41	20.81	2.3	71.6	17.8	10.6	Loam
S.D.			2.63	7.23	2.78	3.72	8782.4	21.29	1222.63	0.0	0.16	1.08	1.72	1.82	0.0	23.5	16.57	7.7	
Mudstone:	24	4																	Sandy
Mean			3.12	3.13	4.70	4.28	11074.13	70.31	233.96	.1	0.28	8.0	1.10	23.99	–	71.5	20.5	8.0	Loam
S.D.			2.36	2.89	12.76	12.58	5350.17	79.99	275.10	0.0	0.23	0.31	1.12	4.88	–	13.77	15.2	3.56	
Interbeds:	15	3																	Loamy
Mean			4.34	7.98	2.79	1.30	10982.13	21.58	346.95	.1	0.12	8.05	1.58	20.56	–	75.33	17.00	7.67	Sandy
S.D.			3.13	6.37	1.85	1.36	6584.59	9.97	359.46	0.0	0.11	0.23	0.92	1.33	–	7.64	9.54	3.06	
Carb-mudstone:	25	3																	Sandy
Mean			6.19	6.51	3.7	2.4	9933.76	58.04	438.86	.1	0.42	7.53	1.54	34.76	2.3	73.33	18.00	5.76	Loam
S.D.			4.85	8.42	4.85	3.98	6112.12	38.94	378.81	0.0	0.34	0.85	1.14	9.94	3.29	20.60	16.82	3.53	
Coal (Blind Canyon)	8	0																	
Mean			1.55	1.81	1.68	1.63	2089.38	10.19	103.88	.1	.06	8.0	.36	60.66	0.44				
S.D.			0.59	2.88	1.35	1.27	2557.56	8.82	66.88	0.0	.05	0.25	.05	18.59	0.06				
Coal (Hiawatha)	2	0																	
Mean			1.52	2.85	1.41	1.58	2532.41	10.82	97.32	.1	0.12	7.95	0.34	60.24	0.51				
S.D.			0.66	3.64	0.95	1.18	2718.02	8.41	72.14	0.0	0.21	0.24	0.07	16.84	0.06				
Starpoint Sandstone																			
Sandstone	11	4																	Sandy
Mean			5.14	8.58	3.42	3.57	3798	9.47	1457.0	.1	0.11	6.76	2.49	30.46	–	90.75	4.75	4.50	~~Loam~~
S.D.			3.89	4.69	2.97	5.18	2965.0	6.98	2578.0	0.0	0.24	1.54	1.20	4.8	–	4.80	3.50	1.91	

1 SAR = Sodium Absorption Ration
2 EC – Electrical Conductivity

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DEER CREEK MINE
WASTE ROCK MATERIAL
ANALYSIS

SAMPLE	pH	EC	% $CaCO_3$	SAR	% SAND	% SILT	% CLAY	TEXTURE CLASS	BORON (mg/kg)	SELENIUM (mg/kg)	% ROCK FRAGMENTS	SATURATION %	% SULFUR NON-SULFATE	% SULFUR PYRITIC	ORGANIC
1-82988[2]	7.43	5.12	26.3	5.0	55.3	23.3	21.4	SCL	1.2	0.098	88.8	30.6	0.31	0.03	0.28

1- Analysis completed according to methods identified in DOGM Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining.

2- Sample is a representative sample composited from five (5) sample sites.

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NPI Soil Testing/Plant Tissue Analysis Lab
417 Wakara Way, Salt Lake City, Utah 84108
Von Isman (801) 582-0144

TOTAL P. 2

CHAPTER 7
HYDROLOGY

7.10 Introduction

7.1.1 General Requirements

This chapter was prepared by the applicant, BRC Wellington LLC ("BRCW"), and presents a description of:

- Existing hydrologic resources within the permit and adjacent areas;
- Proposed operations and the potential impacts to the hydrologic balance;
- Methods of compliance with design criteria;
- Applicable hydrologic performance standards; and
- Hydrologic reclamation plans for the Deer Creek waste rock site (the "Deer Creek site" or the "site").

7.1.2 Certification

All appropriate maps, plans, and cross sections presented in this chapter have been certified by a qualified, registered professional engineer.

7.1.3 Inspection

Impoundments associated with the operations discussed herein will be inspected as described in Section 5.1.4.3 of this application.

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7.20 Environmental Description

7.2.1 General Requirements

This section presents a description of the pre-operational hydrologic resources within the permit and adjacent areas that may be affected or impacted by the operation and reclamation of the site.

7.2.2 Cross Sections and Maps

7.2.2.1 Location and Extent of Subsurface Water

A generalized hydrostratigraphic cross section of the region is presented in Figure 7-1. As indicated in Chapter 6 of this application, Rocks exposed on the surface of the permit area are marine-derived mudstones in the lower portion of the Masuk Member of the Mancos Shale. A test hole drilled at the site of the existing waste rock pile encountered groundwater at a depth of 33 feet below ground surface (see Appendix 5-3). The static water level was reported at a depth of 23 feet below ground surface in this hole. The subsurface material at this location was report as being "relatively impervious" in the upper 43 feet of the boring, with a hydraulic conductivity that ranged from 347 to 763 feet per year (1.0 to 2.1 ft/day) in the zone from 43 to 82 feet below ground surface).

It is assumed that groundwater occurs continuously beneath the site. Groundwater in the area is recharged by infiltration of local precipitation. However, given the low permeability of the shale that occurs on the surface, this groundwater is not available for beneficial use. Energy West installed a monitoring well at the site in 1989 at the location indicated on Figure 7-2 and has monitored this well continuously since that time. A completion log of this well is provided

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in Appendix 7-1. Additional information regarding the data collected from that well is provided in Section 7.2.4.1 of this application.

7.2.2.2 Location of Surface Water Bodies

A map showing the location of surface water bodies in the area is provided in Figure 7-3. No surface water bodies exist within the permit area. However, the map shows the following nearby surface water bodies:

- An evaporation pond located southwest of the permit area and maintained by Rocky Mountain Power Company in conjunction with the nearby Huntington Power Plant
- A small evaporation pond located east of the permit area adjacent to the coal-blending site operated by Rocky Mountain Power Company. This pond is located approximately 100 feet higher in elevation than the existing waste rock site and is, therefore, not in an area that could be impacted by site operations.
- Huntington Creek, which flows from northwest to southeast immediately south of the permit area.

7.2.2.3 Locations of Monitoring Stations

Energy West installed a monitoring well in 1989 at the location shown on Figure 7-2 to monitor groundwater near the waste rock pile. The location of this monitoring well was selected in consultation with DOGM.

No perennial surface water bodies exist in the permit area. Thus, no surface water monitoring stations have been established for this site.

As indicated in Section 7.4.2.2, a sedimentation pond has been constructed on the west side of the existing waste rock pile. This pond was designed as a total containment structure, with the ability to contain twice the amount of runoff expected from a 100-year, 24-hour precipitation event. Hence, since discharge from the pond does not occur, the pond is not monitored.

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7.2.2.4 Location and Depth of Water Wells

No water-supply wells currently exist in the permit area. A search of files maintained by the Utah Division of Water Rights also indicated that no water-supply wells are located in Sections 5 and 6 of T. 17 S., R. 8 E. (i.e., the general vicinity surrounding the permit area).

7.2.2.5 Surface Topography

Surface topographic features in the permit and adjacent areas are shown on Plate 5-1. The surface contour data presented on this plate were developed by an aerial survey conducted on September 26, 2014 by Aero-graphics. The 2-foot contour interval of this map is sufficient to clearly show surface topography and slope within the permit and adjacent areas.

7.2.3 Sampling and Analysis

The monitoring well located in the permit area was installed by Energy West in 1989 and has been monitored on a quarterly basis since that time. All samples have been collected and analyzed in accordance with standard procedures and in accordance with the requirements of R645-301-723. Given the extensive data base generated by monitoring this well over a 25-year period, continued quarterly monitoring of this well is considered unnecessary. However, at the request of the Division, BRCW will continue to monitor this well quarterly prior to abandonment of the well at the beginning of site reclamation. Proposed parameters to be analyzed are listed in Table 7-1.

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7.2.4 Baseline Information

Surface water, groundwater, and climatic resource information is presented in this section to assist in determining the baseline hydrologic conditions which exist in the permit area. This information provides background data on the hydrologic balance of the area.

7.2.4.1 Groundwater Information

Groundwater in the permit area exists in shale weathered from the Masuk Member of the Mancos Shale. Groundwater in the area is recharged by infiltration of local precipitation. Data collected from the on-site monitoring well, as downloaded from the Division of Oil, Ga and Mining web site, are provided in Appendix 7-2. As indicated therein, groundwater at the site is saline, with an average total dissolved solids concentration of approximately 18,400 mg/l during the 25-year monitoring period. As would be expected for groundwater occurring in gypsiferous shale, the predominant anion in groundwater at the site is sulfate. The dominant cation is sodium.

Figure 7-4 shows concentration trends for sulfate, sodium, and total dissolved solids during the period of record. As indicated, concentrations of these constituents have been generally decreasing during the past 25 years. Hence, it is reasonable to conclude that storage of waste rock at the site has not adversely impacted groundwater quality.

As indicated in Section 7.2.2.1, the Masuk Member is only minimally permeable. Given the low permeability of the shale in which groundwater occurs and the saline nature of this groundwater, groundwater in the permit area is poorly suited for domestic, irrigation, or other beneficial uses.

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7.2.4.2 Surface Water Information

The Deer Creek site is located on land that drains to the south toward Miller Creek, located approximately 3,000 feet south of the waste rock pile. No perennial streams are located in the permit area. Drainage in the area occurs as overland flow or in ephemeral washes that flow only in direct response to precipitation events.

Huntington Creek is a perennial tributary of the San Rafael River. The U.S. Geological Survey maintained a stream gaging station on Huntington Creek from May 1909 to October 1979 at location approximately 800 feet south of the intersection of the site access road with State Route 31. Data downloaded from the USGS National Water Information System[1] collected from this gaging station are provided in Appendix 7-3. These data indicate that the average annual streamflow of Huntington Creek during the 70-year period of record was 109.0 cubic feet per second ("cfs"). Average monthly streamflow during this period of record ranged from a low of 28 cfs (during the months of December and January) to a high of 33 cfs (during the month of May). The peak flow recorded at this gaging station was 2,500 cfs on August 2, 1930. Annual peak flows on Huntington Creek generally occurred in May/June due to snowmelt runoff or in August/ September due to high-intensity thunderstorms.

Published water quality data for the San Rafael River basin indicate that the quality of surface water decreases as it flows from the Wasatch Plateau toward the Green River. This decrease is attributed to the presence of soluble minerals in the surrounding rocks (principally the Mancos Shale), saline soils, and irrigation return flows. Typical TDS values are 150 to 300 mg/L in the upper reaches of Huntington Creek, 2,000 to 2,600 mg/L near Huntington, and 4,000 to 5,500 mg/L at the confluence with the San Rafael River, approximately 20 miles downstream from the permit area (Mundorff and Thompson, 1982).

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[1] http://nwis.waterdata.usgs.gov/nwis

7.2.4.3 Geologic Information

Geologic information related to the permit and adjacent areas is presented in Chapter 6 of this document.

7.2.4.4 Climatological Information

Data obtained from the Western Regional Climate Center[2] indicate that average annual precipitation at Castle Dale (located about 12 miles south-southeast of the site) was 7.89 inches for eh 115-year period of record from February 1899 through December 2014 (see Appendix 7-4). Nearly one-fourth of this precipitation normally occurs in the months of August and September due to summer thunderstorms. Annual precipitation at Castle Dale has ranged from a low of 3.29 inches in 1934 to a high of 14.28 inches in 1965. The maximum recorded daily precipitation occurred on August 28, 2007 with a rainfall depth of 2.15 inches.

The average annual temperature at the Castle Dale station during the period of record was 46.8° F. Seasonally, this temperature has varied from an average monthly minimum of 6.7° F in January to an average monthly maximum of 88.5° F in July. The lowest temperature recorded at Castle Dale (-35° F) was measured on February 10, 1933. This highest recorded temperature (107° F) was measured on July 13, 2002.

The station closest to the site that reports wind data is located at the Price-Carbon County Airport, Utah (approximately 23 miles northeast of the site). The average annual wind speed at this location between September 1998 and September 2008 was 6.9 mph (see Appendix 7-4). A maximum wind gust of 71 mph was recorded at the Price station on May 30, 1999.

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[2] www.wrcc.dri.edu

7.2.4.5 Supplemental Information

No supplemental information is required at this time.

7.2.4.6 Survey of Renewable Resource Lands

The existence and recharge of aquifers in the permit and adjacent areas is discussed in Sections 7.2.2.1 and 7.2.4.1 of this document.

7.2.4.7 Alluvial Valley Floor Requirements

Information regarding the presence or absence of alluvial valley floors in the permit and adjacent areas is presented in Chapter 9 of this document.

7.2.5 Baseline Cumulative Impact Area Information

Information concerning the hydrology of the region is available in various publications, including Mundorff and Thompson (1982), Waddell et al. (1981), and Gloyn et al. (2003). Since the hydrologic impact of the operations will be insignificant, it is not anticipated that revisions will be needed to the Cumulative Hydrologic Impact Assessment of the area.

7.2.6 Modeling

No numerical groundwater or surface water modeling was conducted in support of this document.

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7.2.7 Alternative Water Source Information

No surface mining has been or will be conducted in the permit and adjacent areas. Therefore, this section does not apply to the Deer Creek site.

7.2.8 Probable Hydrologic Consequences

This section addresses the probable hydrologic consequences of coal recovery and reclamation operations in the permit and adjacent areas. Mitigating measures are discussed generally in this section and as well as in Section 7.30 of this document.

7.2.8.1 Potential Impacts to Surface and Groundwater

It is anticipated that coal recovery and reclamation operations at the site will not adversely impact the quality and quantity of surface and groundwater in the area. This conclusion is based on the facts that no perennial surface-water sources exist within the permit area, that erosion and sediment yield are adequately controlled through on-site practices, and that the natural quality and quantity of groundwater in the area precludes its beneficial use. Additional information regarding the potential hydrologic impacts of coal recovery and reclamation operations at the site is addressed in the following sections of this document.

7.2.8.2 Baseline Hydrologic and Geologic Information

Baseline geologic information is presented in Chapter 6 of this document. Baseline hydrologic information is presented in Sections 7.2.4.1 and 7.2.4.2 of this document.

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7.2.8.3 PHC Determination

Potential Impacts to the Hydrologic Balance. Potential impacts to the hydrologic balance are addressed in the following subsections of this document.

Acid- or Toxic- Forming Materials. As noted in Section 6.2.3 of this application, the waste rock from which the coal will be recovered is neither acid- nor toxic-forming. Thus, no impacts will occur at the site due to the presence of acid- or toxic-forming materials.

Sediment Yield. The potential impact of coal recovery and reclamation on sediment yield is an increase in sediment in the surface waters downstream from disturbed areas. Sediment-control measures (such as a sedimentation pond, silt fencing, drainage ditches, etc.) have been designed and constructed to minimize this impact. All runoff from the facility is directed toward the on-site sedimentation pond, straw wattles, or silt fences, thereby capturing sediment and precluding its off-site discharge. The sedimentation pond is designed as a total containment structure. Nonetheless, this pond contains an emergency spillway to control discharge in the unlikely event that the pond overflow. All runoff controls will be regularly inspected (see Section 5.1.4) and maintained.

Planned reclamation practices include leaving the surface of reclaimed areas in a roughened state. This practice will enhance moisture retention and revegetation success, thereby reducing post-reclamation sediment yields to levels that are substantially lower than would naturally occur on the site under pre-operations conditions (see Appendix 7-5). Hence, activities at the site will greatly minimize the potential for off-site impacts from sediment.

Acidity, Total Suspended Solids, and Total Dissolved Solids. Probable impacts of operations on the acidity and total suspended solids concentrations of surface and groundwater in

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the permit and adjacent areas were addressed previously in this section. By retaining runoff on site, natural contributions of salinity to regional surface waters will also be reduced.

Flooding or Streamflow Alteration. The disturbed area is isolated from surrounding areas by runoff control structures such as straw wattles, silt fences, diversion ditches, and a sedimentation pond. Runoff from all disturbed areas flows to sediment controls prior to discharge to adjacent undisturbed drainages. Since no mining or exploration will occur at this site, there will be no impacts due to subsidence. Thus, impacts due to flooding or streamflow alteration will not occur.

Groundwater and Surface Water Availability. Runoff controls at the site will minimize impacts to adjacent surface resources. As noted in Section 7.2.4.2, impacts to groundwater are also considered to be insignificant due to a combination of limited groundwater resources, poor groundwater quality, and relatively impermeable geologic materials at the site. Furthermore, coal recovery and reclamation operations will use only limited amounts of water (primarily for dust suppression), thereby further minimizing potential adverse impacts to surface and groundwater.

Potential Hydrocarbon Contamination. Diesel fuel, oils, greases, and other hydrocarbon products will be used at the site for equipment operation. Diesel will either be transported to the site in a mobile fueling truck or stored in a temporary above-ground tank that will be provided with secondary containment. Spills onto the ground have the potential to occur during filling of the storage tank or filling of mobile equipment. Similarly, spills of grease and oil may potentially occur during use at the site.

The probable future extent of the contamination caused by diesel and oil spillage is expected to be small for four reasons. First, any on-site storage will be temporary. Second, any tanks or drums stored on site will be provided with secondary containment structures that prevent leaks from reaching the ground. Third, spills caused by filling operations outside of the secondary

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containment structures will be minimized due to the economic value of the product. Fourth, because filling operations and potential on-site storage will all occur above ground, leakage from these operations will be readily detected and mitigated.

Road Salting. No salting of the haul road occurs within the permit area. Hence, no impact will result from this action in the permit or adjacent areas.

Coal Haulage. Coal will be hauled on the access road within the permit area. If coal is spilled, it will be promptly picked up. In addition to spills, wind may carry coal dust or small pieces of coal away from recovery operations and the open top of coal trucks. Fugitive dust control measures will be implemented at the site, including watering of piles, crushing operations, and screening operations as needed. Coal truck speed will be minimized by access road site distances. There, the impact from fugitive coal dust is considered to be insignificant due to the fugitive dust control measures implemented at the site.

7.2.9 Cumulative Hydrologic Impact Assessment (CHIA)

Information is provided in this application that will allow DOGM to update a Cumulative Hydrologic Impact Assessment if necessary.

7.30 Operation Plan

7.3.1 General Requirements

This permit application includes an operation plan which addresses the following:

- Groundwater and Surface Water Protection and Monitoring Plan
- Design Criteria and Plans

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- Performance Standards
- Reclamation Plan.

7.3.1.1 Hydrologic-Balance Protection

Groundwater Protection. As indicated in Section 6.2.3, neither acid- nor toxic-forming materials are present in the permit area. Furthermore, groundwater quality data collected from an on-site monitoring well since 1989 indicate that the salinity of groundwater at the site has been decreasing during the past 25 years. Since the operations proposed herein consist of the recovery of coal from an existing waste rock pile and eventual reclamation of the site, BRCW operations will not adversely impacted groundwater quality.

Surface Water Protection. A runoff control plan has been implemented to minimize, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area, and otherwise prevent water pollution. BRCW will maintain adequate runoff- and sediment-control facilities to protect local surface waters during coal recovery and reclamation operations at the site.

7.3.1.2 Water Monitoring

Groundwater Monitoring. Energy West installed one groundwater monitoring well within the permit area in 1989. Monitoring of this well will occur as outlined in Section 7.2.3.

Surface Water Monitoring. No intermittent or perennial streams exist within permit area. The sedimentation pond at the site is designed for total containment. Therefore, no surface water monitoring will be conducted in conjunction with this application.

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7.3.1.3 Acid- and Toxic-Forming Materials

As noted in Section 6.2.3 of this application, the waste rock from which the coal will be recovered is neither acid- nor toxic-forming. Thus, no acid- or toxic-forming materials exist on the site.

7.3.1.4 Transfer of Wells

No wells exist at the facility.

7.3.1.5 Discharges

No discharges will occur into, from, or within underground mines in the permit area. Operations at the site will be conducted in a manner that precludes contamination, diminishment, or interruption of State-appropriated water supplies.

7.3.1.6 Stream Buffer Zones

No operations in the permit area will be conducted within 100 feet of any perennial or intermittent stream channels. Thus, no buffer zones have been designated.

7.3.1.7 Cross Sections and Maps

Maps showing the locations of appropriated points of diversion for current users of surface water in the general area are provided in Appendix 7-6. These maps and the associated data were downloaded from the Utah Division of Water Rights web site.[3]

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[3] http://www.waterrights.utah.gov/wrinfo/default.asp

Plate 7-1 shows the location and cross sections of the existing sedimentation pond as well as the location of an emergency spillway on the sedimentation pond. It is not anticipated that water will discharge from the sedimentation pond since it is designed as a total containment structure.

The locations of ditches and culverts used to divert water at the site are shown on Plate 7-2. The location of the site monitoring well is noted on Figure 7-2. No other water monitoring stations exist in the permit and adjacent areas.

7.3.1.8 Water Rights and Replacement

BRCW will replace the water supply of an owner of interest in real property who obtains all or part of his or her supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source, where that supply has been adversely impacted by contamination, diminution, or interruption proximately resulting from activities conducted by BRCW in the permit area.

7.3.2 Sediment Control Measures

The existing sediment control measures within the permit area have been designed, constructed, and maintained to prevent additional contributions of sediment to streams or to runoff outside the permit area. In addition, they have been designed to meet applicable effluent limitations, and minimize erosion. The structures that control runoff at the site include diversion channels, a sedimentation pond, containment berms, straw wattles, silt fences, and road diversions and culverts.

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7.3.2.1 Siltation Structures

The siltation structures within the permit area consist of the sedimentation pond described in Section 7.3.2.2.

7.3.2.2 Sedimentation Ponds

A sedimentation pond was constructed by Energy West immediately west of the waste rock pile as indicated on Plate 7-1. This pond was designed as a total-containment structure (see Section 7.4.2.2). Thus, runoff collected in this pond is allowed to evaporate or percolate into the ground. Sediment that accumulates in the ponds will be removed as needed. Runoff may be pumped out of the sediment pond and used for dust suppression in accordance with the air quality permit. If used, this water will be applied to non-paved areas within the disturbed-area boundary. As such, any excess water applied for dust suppression will be captured by sediment controls that have been installed at the site (i.e., the sedimentation pond, straw wattles, or silt fences).

Compliance Requirements. The sedimentation pond will be maintained until the site is reclaimed. The sedimentation ponds were designed to contain sediment in addition to the runoff resulting from two back-to-back 100-year, 24-hour storm events. The spillway on the sedimentation pond was designed to adequately pass the peak flow resulting from the 100-year, 24-hour precipitation event.

MSHA Requirements. The sedimentation pond at the site does not meet the size criteria of MSHA requirements defined in 30 CFR 77.216.

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7.3.2.3 Diversions

The objective of the runoff control plan is to isolate, to the maximum degree possible, runoff from disturbed areas. All diversion ditches are maintained with adequate erosion protection in the ditch sections where flow velocities are great enough that a ditch lining is necessary. Adequate ditch capacities are maintained in all ditch sections. Culverts are kept free of debris. Detailed diversion design information is presented in Section 7.4.2.

7.3.2.4 Road Drainage

Road drainage facilities include diversion ditches and culverts. Additional road drainage design information is presented in Section 7.4.2. All road drainage systems will be maintained and repaired as needed following the occurrence of a large storm event. Culvert inlets and outlets will be kept clear of sediment and other debris.

7.3.3 Impoundments

7.3.3.1 General Plans

One sedimentation pond has been constructed at the site as described above.

Certification. Maps and cross sections of the sedimentation pond have been prepared by or under the direction of and certified by a qualified, registered, professional engineer.

Maps and Cross Sections. The topography and cross sections for the sedimentation pond are located on Plate 7-1.

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Narrative. A description of the sedimentation pond is presented in Sections 7.3.2.2 and 7.4.2 of this document.

Subsidence Survey Results. Since no mining occurs at the site, a subsidence survey is not presented.

Hydrologic Impact. The hydrologic and geologic information required to assess the hydrologic impacts of the impoundments can be found in Section 7.2.4 and Chapter 6, respectively.

Design Plans and Construction Schedule. No additional impounding structures are proposed for construction at the site. Designs of all existing structures are described in this document.

7.3.3.2 Permanent and Temporary Impoundments

Requirements. The only impoundment at the site consists of the one sedimentation pond. This pond is a temporary impoundment. The pond was designed and constructed using current, prudent, engineering practices. Since the pond was constructed below grade, it is considered stable. Specific hydrologic design criteria for this pond are presented in Section 7.4.3. The pond will be inspected regularly based on the schedule contained in Section 5.1.4.3. The sedimentation pond meets the requirements of the rules concerning temporary impoundments.

Hazard Notifications. The sedimentation pond will be examined for structural weakness and erosion at least four times per year.

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7.3.4 Discharge Structures

The only discharge structure at the site consists of the emergency spillway on the sedimentation pond. Since the pond was designed as a total-containment structure, discharges from the pond are not anticipated. This discharge structure is further described in Section 7.4.4.

7.3.5 Disposal of Excess Spoil

No excess spoil is generated at the facility.

7.3.6 Coal Mine Waste

The existing waste-rock pile complies with the requirements of R645-301-746. Areas designated for disposal of reject from coal-recovery operations will also be constructed and maintained in accordance with that same regulation.

7.3.7 Noncoal Mine Waste

Non-coal mine waste is not stored or disposed of on site (see Chapter 5).

7.3.8 Temporary Casing and Sealing of Wells

The groundwater monitoring well at the site was constructed in compliance with R645-301-748.

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7.40 Design Criteria and Plans

7.4.1 General Requirements

The criteria set forth in R645-301-740 were used to design structures to control drainage from disturbed and undisturbed areas at the Deer Creek site. Details regarding hydrologic design methods and calculations operational period are presented in Appendix 7-7. It should be noted that the design information presented in Appendix 7-7 was prepared by Energy West based on the assumption that the waste rock pile would eventually be larger than under its current configuration. Thus, these calculations assumed that two sedimentation ponds and associated drainage structures would be constructed. Therefore, the reviewer should ignore the information provided in Appendix 7-7 concerning structures that were not built.

It should be noted that some of the statements in Appendix 7-7 may leave the reader with the impression that sediment control measures other than the sedimentation pond are not needed at the site. For instance, page 4-11 of Appendix 7-7, speaking of the original Phase I site design (i.e., the phase occupied by the existing waste rock pile), states that "all runoff will be drained to the basin on the west end of the site." The use of the word "all" is obviously an over-simplification that refers to runoff from the top of the pile as well as runoff that collects on the inside of the soil storage berm. Runoff from the east side of the waste rock pile and the outside of the soil storage berm is not and never was directed to the sedimentation pond. As a result, alternate sediment controls (straw wattles and silt fences) have been and will continue to be used in these areas to retain sediment within the disturbed area. For these reasons, the reader is encouraged to exercise reasonable judgement when reviewing specific statements in Appendix 7-7. Nonetheless, the design information related to the existing sedimentation pond and the existing diversions is considered applicable to this permit application.

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7.4.2 Sediment Control Measures

7.4.2.1 General Requirements

Design. Existing sediment control measures have been designed, constructed, and maintained to:

- Prevent additional contributions of sediment to stream flow or to runoff outside the permit area,
- Meet the effluent limitations defined in R645-301-751, and
- Minimize erosion to the extent possible.

Measures and Methods. The sediment control measures at the facility include:

- Retention of sediment within the disturbed area;
- Diversion of runoff using channels or culverts through disturbed areas to prevent additional erosion; and
- Provide riprap, a sedimentation pond, silt fencing, and other measures that reduce overland flow velocities, reduce runoff volumes, or trap sediment.

7.4.2.2 Siltation Structures

General Requirements. Additional contributions of suspended solids and sediment to stream flow or runoff outside the permit area is being prevented to the extent possible using a sedimentation pond as a siltation structures. This pond located immediately west of the existing waste rock pile. This structure has been certified by a qualified registered professional engineer and was designed, constructed, and will be maintained as described in Chapter 5 and Sections 7.3.3 and 7.4.3. Sediment yields from area that do not flow to the sedimentation pond will be controlled using silt fences and straw wattles as indicated below in the subsection entitled "Exemptions."

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Sedimentation Ponds. The sedimentation pond was designed to receive runoff from the waste rock pile and its immediate vicinity. The pond is not located in a perennial stream channel.

Sediment Storage Volume. The sedimentation pond was designed to contain 0.1 acre-foot of sediment for each acre drained. Thus, with a design watershed area of 9.8 acres, the pond was constructed with a sediment storage volume of 0.98 acre-foot (42,690 cubic feet). As indicated on Plate 7-1, this sediment storage volume corresponds to an elevation of 6313.45 feet.

Detention Time. The sedimentation pond was designed as a retention pond that will contain all water that flows into it without discharging, thereby meeting applicable effluent limitations. Water may be periodically pumped from the ponds and used for dust suppression within the permit area.

Design Runoff Event. The sedimentation pond is designed to fully contain its inflow. The drainage characteristics, including contributing area, runoff curve number, and hydraulic length for the operational period were calculated as shown in Appendix 7-7. As indicated therein, the runoff storage volume resulting from a 100-year, 24-hour precipitation event was calculated to be 1.11 acre-feet, with the design volume being twice that amount (2.22 acre-feet). However, as indicated on Plate 7-1, the pond was constructed with a runoff storage volume of 3.66 acre-feet above the design maximum sediment storage elevation. Thus, the storm-water storage pool in the pond actually exceeds three times the amount of runoff expected from the 100-year, 24-hour precipitation event.

Sediment Removal. Sediment will be removed from the pond when the sediment level reaches an elevation corresponding to 60% of the total sediment storage volume. As noted on Plate 7-1, the 60% clean-out elevation for the pond is 6312.7 feet. Sediment that contains a significant amount of coal will be recovered and processed at the Wellington coal cleaning facility.

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Sediment that contains an insignificant amount of coal will be placed with reject from coal recovery operations.

Excessive Settlement. The sedimentation pond was excavated into natural soil. Excessive settlement has not been observed and, given the excavated construction, is not anticipated in the future.

Embankment Material. The sedimentation pond was excavated into natural soil and does not contain an embankment. The berms adjacent to the pond are soil stockpiles, not pond embankments.

Compaction. The sedimentation pond was excavated into natural soil and does not contain an embankment. Hence, no embankment materials were compacted.

MSHA Sedimentation Ponds. The sedimentation pond at the site does not meet the size criteria of MSHA requirements defined in 30 CFR 77.216.

Sedimentation Pond Spillways. The sedimentation pond is equipped with an emergency spillway to protect the pond in the extremely unlikely event that discharge occurs. The spillway is trapezoidal in cross section and measures approximately 2 feet deep and 3 feet wide with 2H:1V side slopes and a grouted riprap invert. The spillway was designed to safely discharge the peak flow resulting from the 100-year, 24-hour precipitation event (10.77 cfs) without consideration for routing of that flow through the pond (see Appendix 7-7). In the extremely unlikely event that the pond spills, this water will discharge into the unnamed ephemeral drainage adjacent to the south side of the permit area and along the west side of the site access road, eventually reaching Huntington Creek if it does not first infiltrate. Since the sedimentation pond can store sufficient volume to contain several years' worth of sediment yield and the runoff resulting from over three

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back-to-back-to-back 100-year, 24-hour precipitation events, it is extremely unlikely that the ponds will spill during BRCW operations.

Other Treatment Facilities. No other water treatment facilities are located within the permit area.

Exemptions. Two alternate sediment control areas exist at the site (see Plate 7-2). ASCA-1 occupies 3.46 acres and exists on the outslopes of the waste rock pile and the soil stockpiles. Silt fences and straw wattles will be installed and maintained to control sediment yield from these outslopes. These materials will be installed in accordance with manufacturer's recommendations. Where practical, the soil in these areas has also been revegetated. The effectiveness of these methods at reducing sediment yields in ASCA-1 is further discussed in Appendix 7-8. The calculations in this appendix assume that runoff can discharge beyond the silt fences and straw wattles even though this runoff is retained on the uphill side of those controls. Thus, no sediment is actually yielded from areas protected by these controls.

ASCA-2 consists of 0.73 acre of outslope on the site access road. The effectiveness of revegetation efforts on these outslopes is discussed in Section 3.2.1.2 and Appendix 3-2 of this application. The data presented therein indicate that revegetation of the road outslopes has resulted in ground cover that exceeds that in undisturbed areas. In May 2007, the Division of Oil, Gas and Mining acknowledged that vegetation had established to a point that it alone could control erosion and sedimentation. Approval was granted by the Division and the silt fence along the toe of the embankment fill of the access road was removed.

7.4.2.3 Diversions

General Requirements. The diversions within the permit area consist of drainage ditches and culverts. All diversions within the permit area have been designed to minimize adverse

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impacts to the hydrologic balance, to prevent material damage outside the permit area, and to assure the safety of the public. They have been designed, located, constructed, maintained, and used to:

- Be stable
- Provide protection against flooding and resultant damage to life and property
- Prevent, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area
- Comply with all applicable local, state, and federal laws and regulations

All drainage ditches at the site were installed to divert undisturbed-area runoff away from disturbed areas. Culverts were installed to safely convey this water beneath the site access road.

Diversion of Perennial and Intermittent Streams. There are no diversions of perennial or intermittent streams in the permit area.

Diversion Ditches and Culverts. All diversion ditches adjacent to the waste rock pile were designed based on the peak flow resulting from the 100-year, 24-hour precipitation event. Those adjacent to the site access road were designed based on the peak flow resulting from the 10-year, 24-hour precipitation event. Manning's equation for open channels was used to determine the design flow depth and velocity in each channel. The designed channels are trapezoidal with 3H:1V side slopes and varying bottom widths. Riprap was sized as needed to ensure that the diversion ditches would be non-erosive (see Haan et al., 1994). A filter layer was constructed under the riprap channel lining materials. This filter consists of 2-inch minus road base material and is placed in a layer equal in thickness to that of the median diameter of the overlying riprap.

Calculations used in the design of drainage ditches for the operational period are presented in Appendix 7-7. A summary table of the geometry, channel slope, peak discharge, erosion protection, maximum flow velocity, and minimum depth values for each diversion ditch and culvert at the facility is presented in Table 7-2. Refer to Plate 7-2 for the locations and typical

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cross section of each diversion ditch.

Ditches UD-1 through UD-4 divert runoff from undisturbed areas around the waste rock pile. Ditch UD-4 discharges into a pre-existing man-made channel that was constructed by Utah Power and Light Company to divert runoff around their evaporation pond located south of the permit area. This pre-existing channel is protected from the erosive forces of discharge from UD-4 by a rock apron consisting of the same size and distribution of rocks as the channel lining used in the ditch itself. The apron is fan shaped, 12 feet wide on the discharge side, and extends 15 feet from the end of the ditch (see Plate 7-2).

Ditches UD-5 through UD-7 are constructed along the east side of the site access road. These ditches drain to culverts that convey runoff beneath the road to the adjacent ephemeral channel. As indicated on Plate 5-1, these ditches were typically constructed with 3H:1V side slopes adjacent to the road and 1.5H:1V side slopes on the opposite bank. The ditches are generally 1 foot deep.

Six culverts were installed in the permit area along the site access road. Each culvert consists of 18-inch diameter corrugated metal, installed at the locations shown on Plate 7-2. Rock aprons were installed to dissipate energy from the culvert discharge in areas where a table channel does not exist at the culvert outlet. The design of these rock aprons is shown on Plate 7-2.

7.4.2.4 Road Drainage

Drainage control along the site access road includes the use of diversion ditches and culverts. This road is not located in the channel of an intermittent or perennial stream. As noted on Plate 5-1, the surface of the access road was constructed to drain. All roads have been located to minimize downstream sedimentation and flooding. Diversion ditches and culverts for all roads are described in Section 7.4.2.3 above.

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7.4.3 Impoundments

The existing impoundment within the permit area consists of one sedimentation pond along the western boundary of the waste rock pile. Pertinent information regarding this pond is presented in Sections 7.3.2.2 and 7.4.2.2.

7.4.4 Discharge Structures

7.4.4.1 Erosion Protection

As indicated in Section 7.4.2.2, a spillway was constructed on the sedimentation pond to safely discharge the peak flow resulting from the 100-year, 24-hour precipitation event in the extremely unlikely event that such a discharge would occur (since the pond was designed as a total containment structure). As noted on Plate 7-1, this spillway was designed with roughness elements to dissipate the energy associated with any outflowing water.

Rock aprons (see Plate 7-2) have been installed where channel UD-4 discharges into a pre-existing man-made channel and at locations where culverts discharge onto unstable areas. The purpose of these rock aprons was to dissipate energy at the points of discharge.

7.4.4.2 Design Standards

All discharge structures within the permit area were designed and constructed according to standard engineering design procedures.

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7.4.5 Disposal of Excess Spoil

No excess spoil is generated or disposed of within the permit area.

7.4.6 Coal Mine Waste

7.4.6.1 General Requirements

Reject from coal recovery operations will be placed within the footprint of the existing waste rock pile. By placing this material within the existing footprint (i.e., within the area that is currently designed to control off-site impacts), this reject will be placed in a manner that minimizes adverse impacts to surface and groundwater quantity and quality.

7.4.6.2 Refuse Piles

As indicated on Plate 5-1, a wet-weather seep exists beneath the existing waste rock pile. A drainage system was installed to divert the water from this seep prior to placement of the soil stockpile and the waste rock. This diversion system consists of a 4-inch diameter perforated drain pipe around which an envelope of 2-inch rock was placed at a thickness of 12 inches. The rock envelope was wrapped in a non-woven filter fabric and then covered with 12 inches of clay prior to placing the waste rock fill.

Coal recovery operations will be conducted in such a manner that runoff from the waste rock pile will either flow to the sedimentation pond or be controlled from off-site discharge by temporary pollution-prevention methods such as silt fences, soil berms, straw wattles, etc. Specifically, a berm will be maintained along the outside of the waste rock pile as it is excavated. This berm will continue to direct surface runoff from the top of the pile toward the sedimentation pond as indicated in Figure 7-5. Some surface runoff may collect locally in excavations, but the

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peripheral berm will keep water from discharging from the top of the pile to locations outside of the disturbed area boundary. Silt fences and straw wattles will be maintained during coal recovery operations at the downstream edge of ASCA-1 (shown on Plate 7-2) to continue providing sediment control in areas that cannot flow to the sedimentation pond.

7.4.6.3 Impounding Structures

No impounding structures will be constructed of coal mine waste or used to impound coal mine waste within the permit area.

7.4.6.4 Return of Coal Processing Waste to Underground Workings

No underground workings are located at this facility. No reject from coal recovery operations will be returned to underground workings.

7.4.7 Disposal of Noncoal Mine Waste

Disposal of noncoal waste is discussed in Section 5.2.8.3 of this application.

7.4.8 Casing and Sealing of Wells

The groundwater monitoring well at the site was cased and sealed at the surface to prevent potential acid or other toxic drainage from entering groundwater via the well. A steel cover protects the well and ensures the safety of people, livestock, wildlife, and machinery.

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7.50 Performance Standards

All operations and reclamation will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, prevent material damage to the hydrologic balance outside the permit area, and support approved post operations land uses.

7.5.1 Water Quality Standards and Effluent Limitations

Discharges of water from disturbed areas will be in compliance with all applicable Utah and federal water quality laws and regulations and with applicable effluent limitations for coal mining contained in 40 CFR Part 434.

7.5.2 Sediment Control Measures

All sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 7.3.2, 7.4.2, and 7.6.0.

7.5.2.1 Siltation Structures and Diversions

Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 7.3.2, 7.4.2, and 7.6.3.

7.5.2.2 Road Drainage

All roads were located, designed, constructed, reconstructed, and will be used, maintained and reclaimed according to plans and designs presented in Sections 7.3.2.4, 7.4.2.4, and 7.6.2. All roads have been designed to:

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- Control or prevent erosion and siltation by maintaining or stabilizing all exposed surfaces in accordance with current, prudent engineering practices;
- Control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area;
- Neither cause nor contribute to, directly or indirectly, the violation of effluent standards given under Section 7.5.1.
- Minimize the diminution to or degradation of the quality or quantity of surface- and ground-water systems;
- Refrain from significantly altering the normal flow of water in streambeds or drainage channels.

7.5.3 Impoundments and Discharge Structures

Impoundments and discharge structures are located, maintained, constructed and will be reclaimed as described in Sections 7.3.3, 7.3.4, 7.4.3, 7.4.5, and 7.6.0.

7.5.4 Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste

Handling and disposal of coal mine waste and noncoal mine waste is described in Sections 7.3.6, 7.3.7, 7.4.6, 7.4.7, 7.6.0 and Chapter 5.

7.5.5 Casing and Sealing of Wells

When no longer needed, the groundwater monitoring well in the permit area will be abandoned in accordance with R645-301-765 and the requirements of the Utah Division of Water Rights.

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7.60 Reclamation

7.6.1 General Requirements

A detailed reclamation plan for the facility is presented in Section 5.40 of this application. BRCW will ensure that all temporary structures are removed and reclaimed. Permanent diversions will be maintained properly and will meet the requirements of the approved reclamation plan for permanent structures and impoundments.

The diversion channels that currently convey runoff around the north and west sides of the waste rock pile are subject to frequent maintenance (due to siltation of the channel as runoff is forced to make substantial changes in flow direction). Therefore, these channels will be removed as part of Phase II site reclamation. The channels shown on Plate 5-3 will be constructed during Phase II reclamation to more efficiently convey across the reclaimed site.

The design of the reclamation channels is detailed in Appendix 7-9 and summarized in Table 7-3. The Phase I channels were designed to safely convey runoff resulting from the 10-year, 24-hour precipitation event while the Phase II reclamation channels were designed to safely convey runoff resulting from a 100-year, 24-hour precipitation event, with a trapezoidal shape and bottom widths varying from 0 (triangular) to 10 feet. The Phase I reclamation channels were designed with 2H:1V side slopes and a depth of 1 foot. All Phase II reclamation channels were designed with 2H:1V side slopes and a riprapped depth of 2 feet. A filter layer, consisting of minus 2-inch road-base gravel, will be installed in the Phase II reclamation channels between the riprap and the underlying native soil.

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7.6.2 Roads

The site access road will be reclaimed when it is no longer needed for site access. Reclamation of the road will include:

- Restoring natural drainage patterns
- Reshaping cut and fill slopes to be compatible with the post-mining land use and to complement the drainage patterns of the surrounding terrain.

7.6.3 Siltation Structures

7.6.3.1 Maintenance of Siltation Structures

The sedimentation pond and other siltation structures (i.e., silt fences, wattles, etc.) will be maintained until removed in accordance with the approved reclamation plan.

7.6.3.2 Removal of Siltation Structures

The sedimentation pond will be retained for a period of at least 2 years after the last augmented seeding following the initiation of reclamation activities (see R645-301-356.300 and R645-301-763). This will be done to satisfy regulatory requirements even though the reject pile will be reclaimed using the proven surface-roughening technique known locally as deep gouging to substantially reduce erosion of the reclaimed surface and essentially eliminate runoff to the pond.

7.6.4 Structure Removal

A timetable for the removal of each structure is presented in Table 5-1.

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7.6.5 Permanent Casing and Sealing of Wells

When no longer needed, the groundwater monitoring well in the permit area will be abandoned in accordance with R645-301-765 and the requirements of the Utah Division of Water Rights.

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Gloyn, R.W., D.E. Tablet, B.T. Tripp, C.E. Bishop, C.D. Morgan, J.W. Gwynn, and R.E. Blackett. 2003. Energy, Mineral, and Groundwater Resources of Carbon and Emery Counties, Utah. Bulletin 132, Utah Geological Survey, Utah Department of Natural Resources. Salt Lake City, Utah.

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Waddell, K.M., P.K. Contratto, C.T. Sumsion, and J.R. Butler. 1981. Hydrologic Reconnaissance of the Wasatch Plateau-Book Cliffs Coal-Fields Area, Utah. Water-Supply Paper 2068. U.S. Geological Survey. Washington, D.C.

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TABLE 7-1

Proposed Groundwater Analytical List

Parameter
Field Measurements
Depth to water
Temperature
pH
Specific conductance
Laboratory Analyses
Bicarbonate as $CaCO_3$
Calcium
Carbonate as $CaCO_3$
Chloride
Iron, dissolved
Iron, total
Magnesium
Manganese, dissolved
Manganese, total
Nitrate/Nitrite as N
Potassium
Sodium
Sulfate
Total dissolved solids

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TABLE 7-2

Summary of Operational Drainage
Ditch Design Data

Structure	Description	Peak Design Flow (cfs)[a]	Design Flow Depth (ft)	Design Flow Velocity (fps)	Design Riprap D_{50} (in)
UD-1	Trapezoidal, 3:1side slopes, 2% channel slope, 1.5' deep, 2' bottom width	8.58	0.62	3.56	3.5
UD-2	Trapezoidal, 3:1side slopes, 2% channel slope, 1.5' deep, 3' bottom width	34.59	1.14	4.72	7
UD-3	Trapezoidal, 3:1side slopes, 2% channel slope, 1.5' deep, 4' bottom width	47.65	1.23	5.03	7
UD-4	Trapezoidal, 3:1side slopes, 4% channel slope, 1.5' deep, 5' bottom width	72.37	1.25	6.59	14
UD-5	Triangular, 3:1side inslope, 1.5: 1 outslope, 2% channel slope, 1' deep	4.29	0.74	3.52	None
UD-6	Triangular, 3:1side inslope, 1.5: 1 outslope, 2% channel slope, 1' deep	4.29	0.69	3.94	None
UD-7	Triangular, 3:1side inslope, 1.5: 1 outslope, 2% channel slope, 1' deep	4.29	0.76	3.33	None

[a] Channels UD-1 through UD-4 were designed based on the peak flow from a 100-yr, 24-hr precipitation event; channels UD-5 through UD-7 were designed based on the peak flow from a 10-yr, 24-hr precipitation event (see Appendix 7-7).

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TABLE 7-3

Reclamation Channel Design Summary

Reclamation Channel	Contributing Watershed	Bottom Width (ft)	Maximum Velocity (ft/s)		Riprap D_{50} (in)
			10-yr, 24-hr	100-yr, 24-hr	
RC-1	RWS-1	8	7.03	8.71	12
RC-2	RWS-2	0	4.66	5.56	4
RC-3	RWS-2	0	4.66	5.56	4
RC-4	RWS-3	2	5.46	6.59	6
RC-5	RWS-1, RWS-2, RWS-3. RWS-5	4	6.01	7.37	9
RC-6	RWS-5	0	4.94	5.91	4
RC7	RWS-4	10	7.32	9.13	12
RC-8	RWS-6	2	6.52	7.86	9
RC-9	RWS-6	2	6.52	7.86	9
RC-10	RWS-7	0	6.05	7.20	9
RC-11	RWS-8	0	6.76	8.04	12

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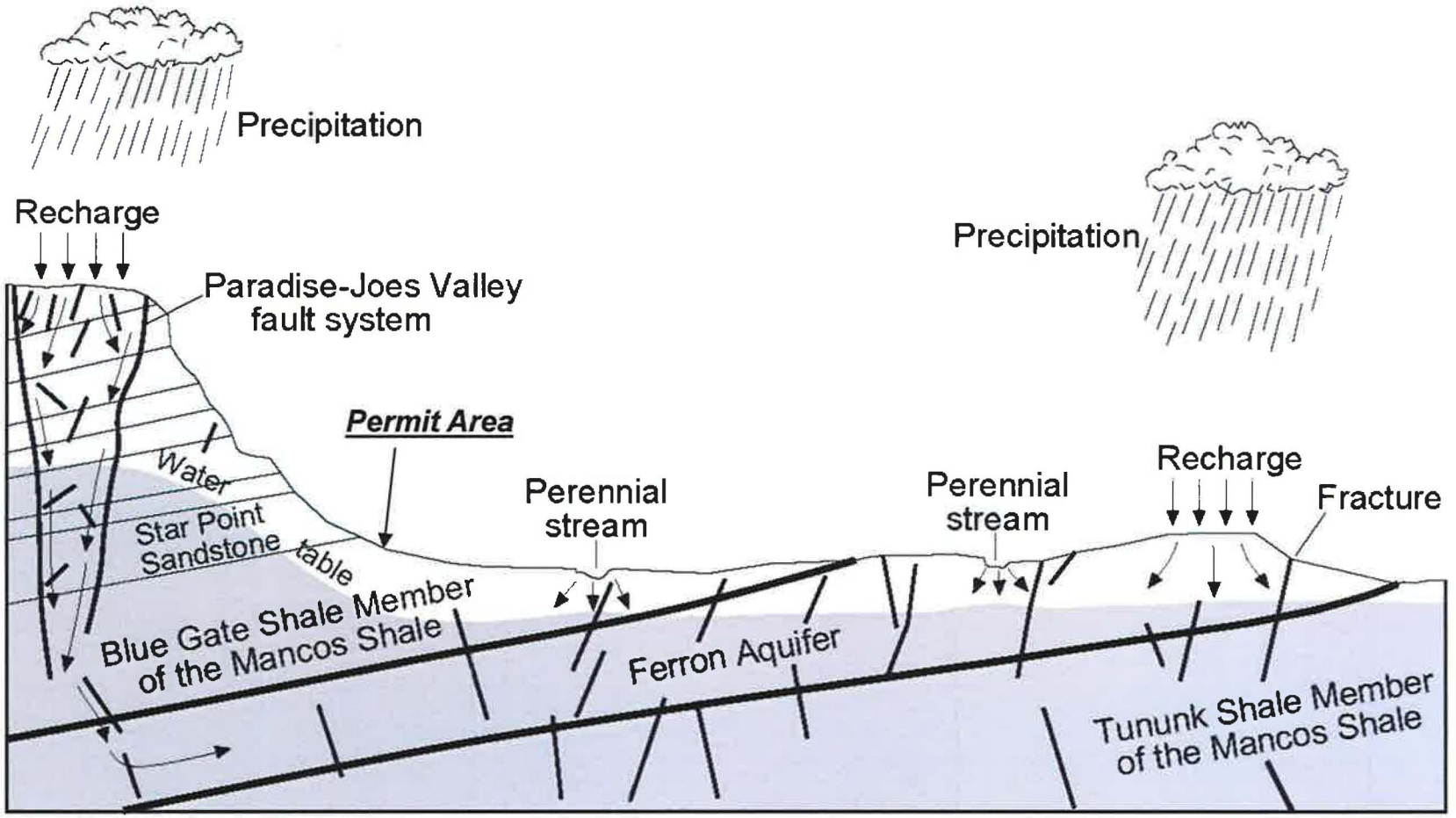

Adapted from Gloyn et al., 2003

FIGURE 7-1. GENERALIZED REGIONAL HYDROSTRATIGRAPHIC CROSS-SECTION

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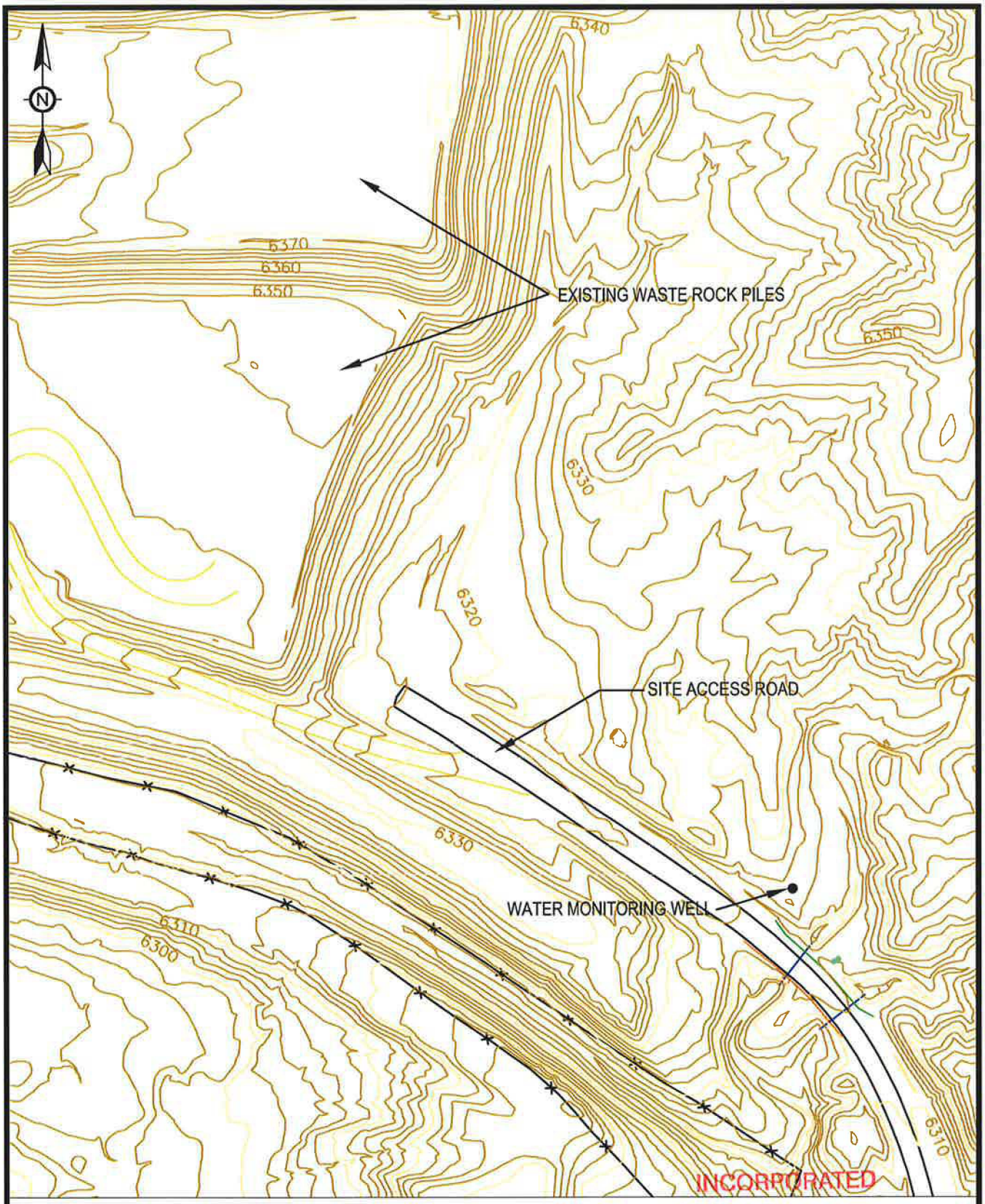

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FIGURE 7-2. MONITORING WELL LOCATION

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BASE PHOTO: GOOGLE EARTH IMAGE DATED 5/31/2013

FIGURE 7-3. SURFACE WATER BODY LOCATIONS

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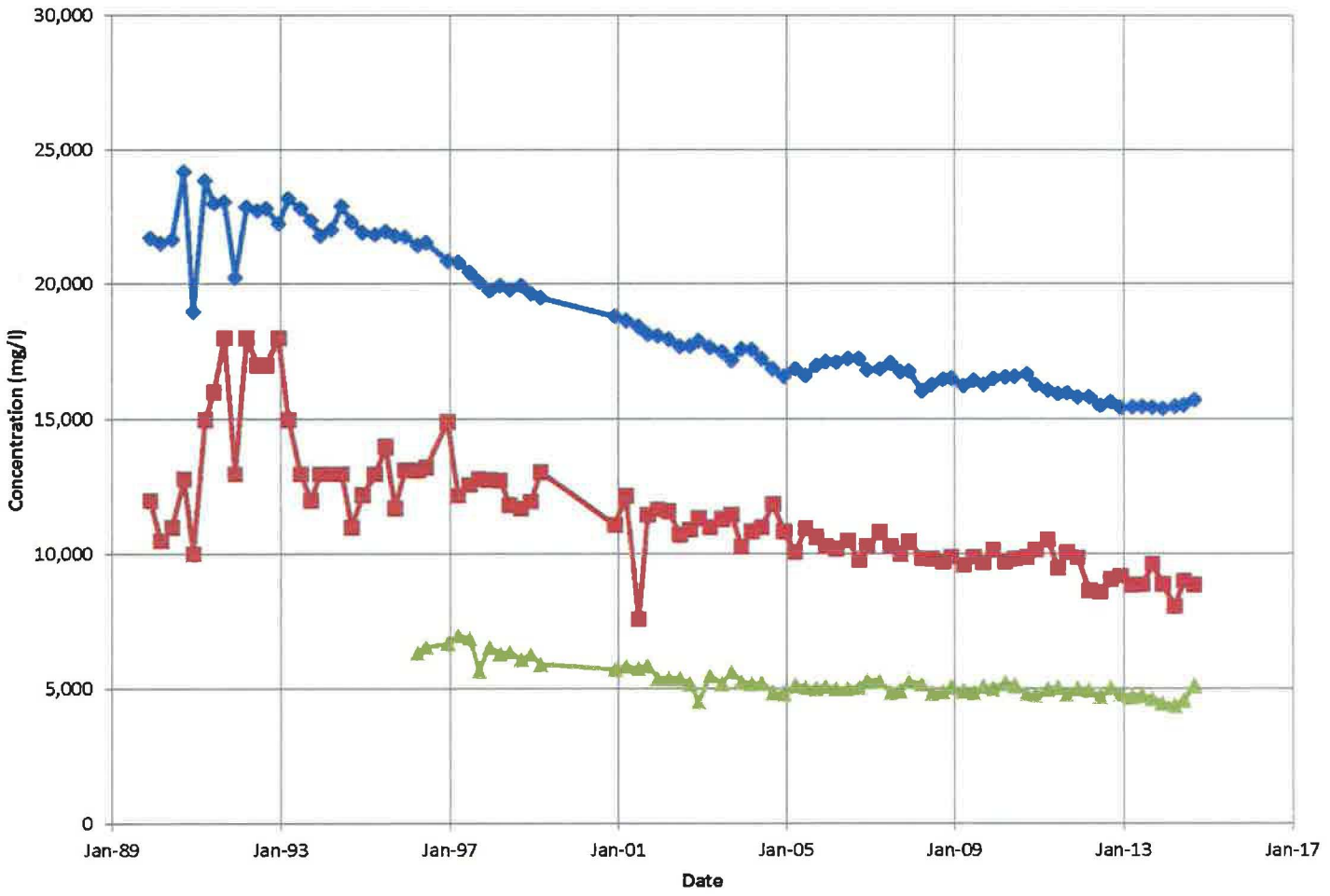

FIGURE 7-4. HISTORIC GROUNDWATER QUALITY DATA

G:\UC1461\05 - Deer Creek waste rock\Draft MRP\DWG\FIGURE 7-4.dwg, 2/3/2016 11:55:55 AM

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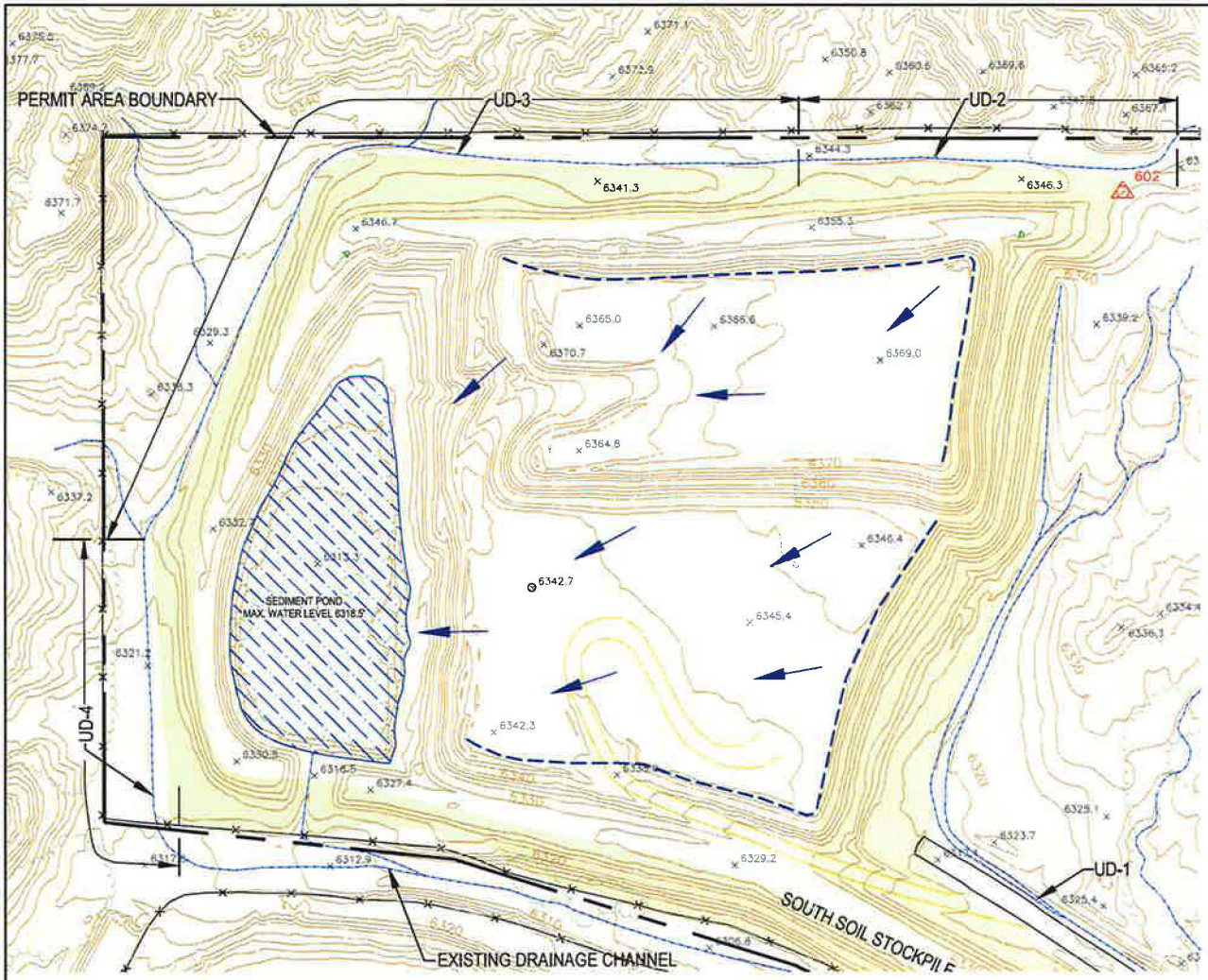
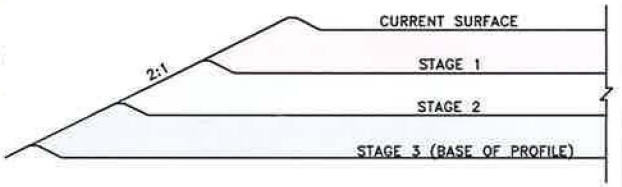


PLAN
SCALE: 1"=100'



TYPICAL PROFILE
NTS

LEGEND

GENERAL DIRECTION OF OVERLAND FLOW

TEMPORARY BERM (TO BE MAINTAINED AT THE TOP OF THE OUTSLOPE AND DIRECT FLOW TOWARD THE SEDIMENTATION POND)

ALTERNATE SEDIMENT CONTROL AREA

FIGURE 7-5. GENERAL SCHEMATIC OF OPERATIONAL SURFACE WATER CONTROLS

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G:\UC1461\05 - Deer Creek waste rock\Draft MRP\DWG\FIGURE 7-5.dwg, 2/3/2016 11:48:51 AM

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APPENDIX 7-1

Monitoring Well Lithologic Log

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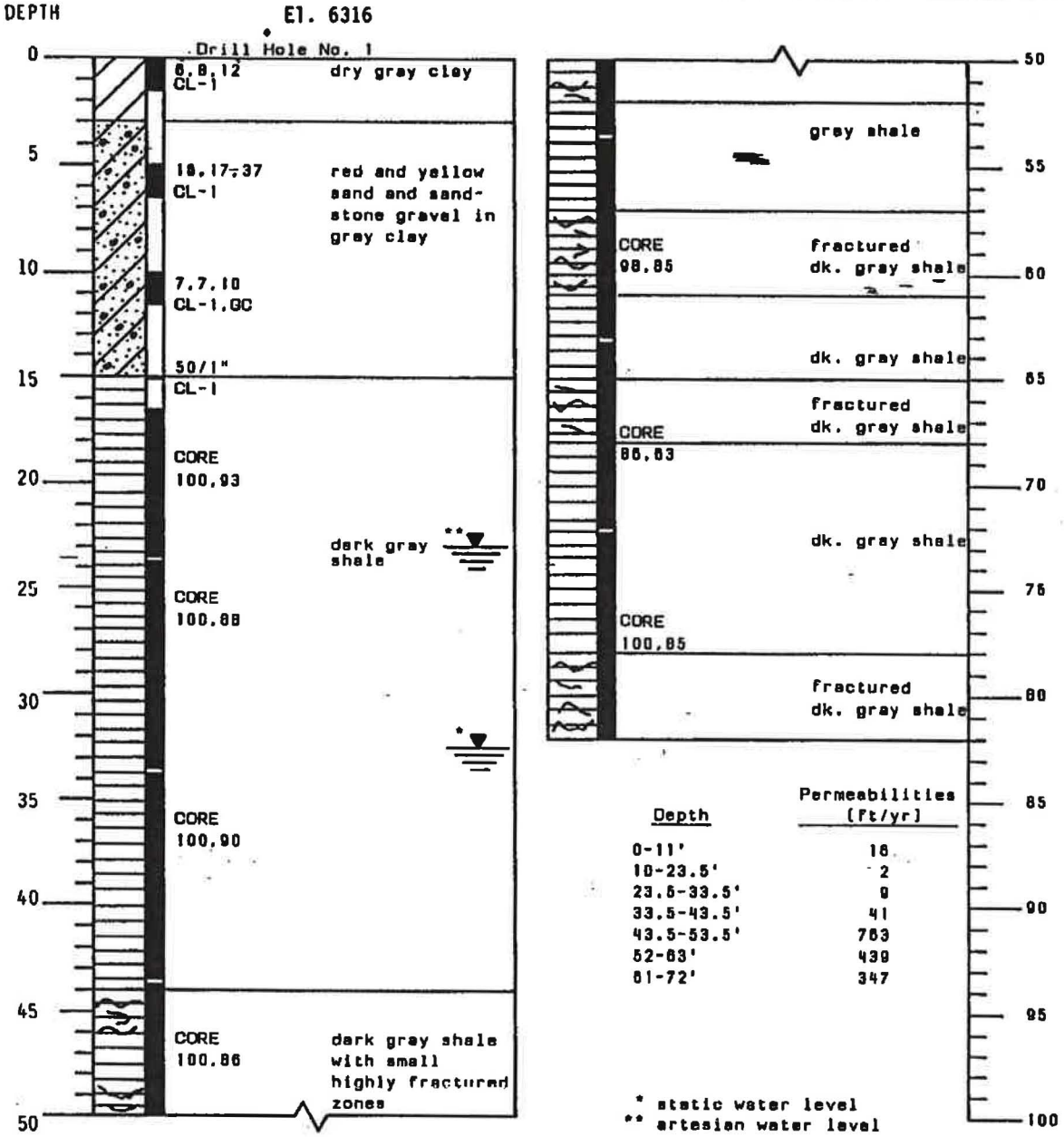

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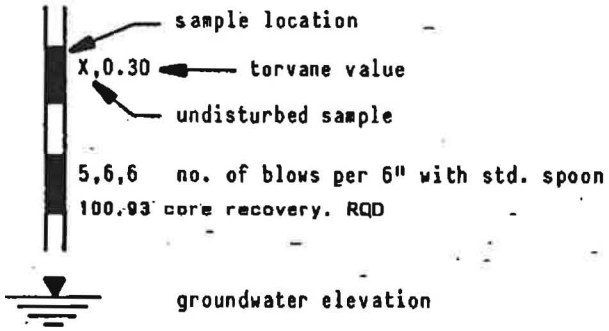

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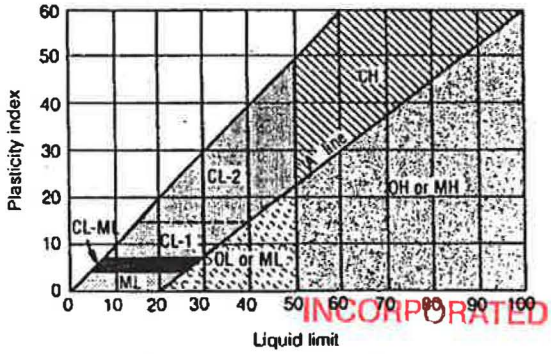
ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

Log of Borings for:
Deer Creek Mine Waste Pile
Utah Power & Light

Figure No. 2

Unified Soil Classification System

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria
Course-grained Soils: More than half of material is larger than No. 200 sieve	Gravels: More than half of coarse fraction is larger than No. 4 sieve size	Clean Gravels (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	Determine percentage of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5% ..... GW, GP, SW, SP; More than 12% ..... GM, GC, SM, SC; 5% to 12% ..... Borderline cases requiring use of dual symbols**
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, poorly graded gravel-sand-clay mixtures	Not meeting all gradation requirements for GW
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures	Atterberg limits below "A" line, or PI less than 4; Atterberg limits above "A" line, or PI greater than 7 — Above "A" line with PI between 4 and 7 are *borderline* cases requiring uses of dual symbols
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines.	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, poorly graded sand-silt mixtures	Atterberg limits below "A" line, or PI less than 4; Atterberg limits above "A" line, or PI greater than 7 — Above "A" line with PI between 4 and 7 are *borderline* cases requiring uses of dual symbols
			SC	Clayey sands, poorly graded sand-clay mixtures	
Fine-grained Soils: More than half of material is smaller than No. 200 sieve	Silts and Clays: Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL 1 / 2	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silt-clays of low plasticity	
	Silts and Clays: Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
Highly Organic Soils			Pt	Peat and other highly organic soils	



Plasticity Chart
For laboratory classification of fine-grained soils

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

**Borderline classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.

Figure No. 4

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APPENDIX 7-2

Groundwater Quality Data

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SUMMARY OF DATA COLLECTED FROM THE
DEER CREEK WASTE ROCK SITE MONITORING WELL
(Data downladed from the Utah Division of Oil, Gas and Ming web site, 28 Jan 2015)

PARAMETER	FROM	TO	ANALYTICAL RESULTS								
			#	MEASURABLE			STANDARD DEVIATION				
				#	MINIMUM	AVERAGE	MAXIMUM	STD	-2 STD	-1 STD	+1 STD	+2 STD
Acidity as CaCO3	6/9/1998	9/3/2014	59	43	5	20.4	36	8.29	3.85	12.13	28.7	36.99
Ammonia as N	12/6/1989	12/6/2011	24	19	0	2.68	5.6	2.26	1.85-	0.41	4.94	7.2
Bicarbonate as CaCO3	12/14/2004	9/3/2014	40	40	426	649.2	700	46.05	557.1	603.15	695.25	741.3
Bicarbonate as HCO3	12/6/1989	9/9/2004	54	54	626	779.8	935	54.72	670.4	725.11	834.55	889.27
Carbonate as CO3	12/6/1989	9/9/2004	54	9	0	1.89	15	5.29	8.69-	3.40-	7.18	12.46
Carbonate as CaCO3	12/14/2004	9/3/2014	40	3	27	49.3	83	24.26	0.81	25.07	73.6	97.86
Cation/Anion Balance	12/13/2001	9/3/2014	52	52	5.000000-	1.26	10.4	3.03	4.79-	1.76-	4.29	7.32
Chloride	12/6/1989	9/3/2014	94	94	17	776.8	1200	187.92	400.97	588.88	964.72	1152.64
Depth	5/19/1989	9/3/2014	97	97	2.99	9.28	29.40	5.62	1.95-	3.66	14.89	20.51
Dissolved Aluminum	4/2/1996	12/6/2011	16	0	0	0	0	0	0	0	0	0
Dissolved Arsenic	4/2/1996	12/6/2011	16	2	0.011	0.016	0.02	1.68	3.34-	1.66-	1.69	3.37
Dissolved Boron	4/2/1996	12/6/2011	16	16	0.78	0.96	1.3	0.35	0.26	0.61	1.32	1.67
Dissolved Cadmium	4/2/1996	12/6/2011	16	1	0.004	0.004	0.004	0	0	0	0	0
Dissolved Calcium	4/2/1996	9/3/2014	69	69	4	109.8	150	17.01	75.82	92.83	126.84	143.85
Dissolved Chromium	4/2/1996	12/16/1996	4	0	0	0	0	0	0	0	0	0
Dissolved Copper	4/2/1996	12/6/2011	16	4	0.01	0.015	0.03	2.06	4.11-	2.05-	2.08	4.14
Dissolved Iron	12/6/1989	9/3/2014	87	22	0.0011	0.138	0.61	0.33	0.53-	0.19-	0.47	0.8
Dissolved Lead	4/2/1996	12/6/2011	15	0	0	0	0	0	0	0	0	0
Dissolved Magnesium	4/2/1996	9/3/2014	69	69	2	159.2	216	36.64	85.88	122.53	195.82	232.46
Dissolved Manganese	4/2/1996	9/3/2014	69	42	0.002	0.013	0.044	0.93	1.85-	0.97-	0.95	1.88
Dissolved Molybdenum	4/2/1996	12/6/2011	16	4	0.008	0.02	0.03	0.48	0.95-	0.46-	0.5	0.99
Dissolved Oxygen (field)	12/6/1989	12/4/2008	20	20	1.2	3.8	6.8	1.62	0.56	2.19	5.43	7.05
Dissolved Potassium	4/2/1996	9/3/2014	68	68	1	15.2	29.6	4.46	6.29	10.75	19.66	24.12
Dissolved Selenium	4/2/1996	12/6/2011	13	2	0.01	0.016	0.022	1.49	2.97-	1.48-	1.51	3
Dissolved Sodium	4/2/1996	9/3/2014	68	68	517	5181.1	6850	803.49	3574.12	4377.61	5984.6	6788.09
Dissolved Zinc	4/2/1996	12/6/2011	16	10	0.008	0.019	0.07	8.96	17.91-	8.94-	8.98	17.95
Elevation of Wate	5/19/1989	9/3/2014	100	100	4.4	4442.6	20640	4798.75	5154.89-	356.14-	9241.36	14040.11
Field Water Temperature	12/6/1989	9/3/2014	87	87	1.59	12.47	18.2	8.01	3.55-	4.46	20.48	28.49
Fluoride	12/6/1989	12/12/1991	8	8	0.08	0.71	0.91	1.03	1.36-	0.32-	1.74	2.78
NO2+NO3 as N	4/2/1996	12/13/2001	8	0	0	0	0	0	0	0	0	0
Nitrate as N	12/6/1989	12/6/2011	16	11	0	0.16	0.36	0.32	0.48-	0.16-	0.49	0.81
Nitrite as N	12/6/1989	12/6/2011	23	8	0	0.26	1.96	0.67	1.09-	0.42-	0.93	1.61
Oil/Grease	3/6/1990	9/25/1990	3	0	0	0	0	0	0	0	0	0
Ortho. Phosphate	4/2/1996	12/6/2011	16	5	0.02	0.28	1.28	0.62	0.97-	0.34-	0.9	1.52
Settleable Solids	3/6/1990	3/28/1991	3	0	0	0	0	0	0	0	0	0
Sp. Conductivity (fld)	6/11/1991	9/3/2014	82	81	800	16155.8	22700	5900.4	4355	10255.39	22056.19	27956.58
Specific Conductivity (Lab)	12/6/1989	9/3/2014	94	94	2360	21490.2	45000	5267.28	10955.66	16222.94	26757.51	32024.79
Sulfate	12/6/1989	9/3/2014	94	94	600	11135.7	18000	2583.34	5969.02	8552.37	13719.06	16302.4
Sulfide	12/6/1989	12/12/1991	6	5	1	12.3	29	24.98	37.62-	12.64-	37.32	62.3
Total Alkalinity as CaCO3	12/6/1989	9/3/2014	94	94	426	649.3	766	40.77	567.75	608.52	690.05	730.82
Total Aluminum	12/6/1989	12/12/1991	8	4	0	0.67	1.56	3.24	5.81-	2.57-	3.91	7.16
Total Anions	12/6/1989	9/3/2014	93	93	49.52	267.00	415.19	54.66	157.67	212.33	321.66	376.32
Total Arsenic	12/6/1989	12/12/1991	8	3	0	0.015	0.042	4.27	8.52-	4.25-	4.28	8.55
Total Barium	12/6/1989	12/12/1991	8	1	0.17	0.17	0.17	0	0.17	0.17	0.17	0.17
Total Boron	12/6/1989	12/12/1991	8	7	0.00106	0.684437	1.23	0.9	1.11-	0.21-	1.58	2.48
Total Cadmium	12/6/1989	12/12/1991	7	3	0	0.015	0.023	0.55	1.08-	0.53-	0.56	1.11
Total Calcium	12/6/1989	12/16/1996	29	29	141	243.5	880.1	152.4	61.31-	91.09	395.89	548.29
Total Cations	12/6/1989	9/3/2014	93	93	41.01	264.84	425.95	63.99	136.86	200.85	328.84	392.83
Total Chromium	12/6/1989	12/12/1991	8	4	70	110	190	47.6	14.79	62.4	157.6	205.21
Total Copper	12/6/1989	12/12/1991	8	7	0.034	0.053	0.07	2.61	5.16-	2.55-	2.66	5.27
Total Dissolved Solids @ 180 C	12/6/1989	9/3/2014	93	93	11466	18427.9	24189	2715.3	12997.3	15712.6	21143.21	23858.51
Total Hardness as CaCO3	12/6/1989	9/3/2014	94	94	318	1142.3	3351	418.06	306.16	724.22	1560.34	1978.4
Total Iron	12/6/1989	9/3/2014	94	94	0.08	1.51	26.02	3.42	5.33-	1.91-	4.93	8.35
Total Lead	12/6/1989	12/12/1991	8	8	0	0.213	0.373	0.66	1.11-	0.45-	0.87	1.54
Total Magnesium	12/6/1989	12/16/1996	28	28	47	238.6	351	68.52	101.59	170.11	307.15	375.67
Total Manganese	12/6/1989	9/3/2014	94	60	0.009	0.030	0.207	1.07	2.11-	1.04-	1.1	2.17
Total Mercury	12/6/1989	12/12/1991	8	1	0	0	0	0	0	0	0	0
Total Molybdenum	12/6/1989	12/12/1991	8	3	0	0.07	0.11	0.6	1.13-	0.53-	0.67	1.27
Total Nickel	12/6/1989	12/12/1991	8	8	90	261.3	470	149.03	36.82-	112.22	410.28	559.32
Total Phosphorus	12/6/1989	12/12/1991	8	3	0	0.02	0.06	7.05	14.07-	7.02-	7.07	14.12
Total Potassium	12/6/1989	12/16/1996	28	28	13	21.0	37.76	7.09	6.81	13.9	28.09	35.18
Total Selenium	12/6/1989	12/12/1991	8	4	0	2.75	5	2.34	1.92-	0.41	5.09	7.42
Total Sodium	12/6/1989	12/16/1996	29	29	71.39	6308.90	8876	2232.02	1844.86	4076.88	8540.92	10772.95
Total Suspended Solids	12/6/1989	12/14/1995	25	25	10	81.9	227	68.22	54.52-	13.7	150.14	218.36
Total Zinc	12/6/1989	9/10/1991	6	6	0.03	0.08	0.15	3.37	6.66-	3.29-	3.46	6.83
Turbidity (Lab)	3/28/1991	3/28/1991	1	1	25	25	25	0	25	25	25	25
pH (fld)	12/6/1989	9/3/2014	85	85	4.86	7.60	9.4	0.67	6.26	6.93	8.28	8.95
pH (lab)	12/6/1989	9/3/2014	94	94	7.30	7.73	8.47	0.19	7.34	7.54	7.92	8.11

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DATE	Field pH pH units	Cond (Field) umhos/cm	Depth feet	WL feet	TSS mg/l	D-Ca mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Na mg/l	Bicarb mg/l	Carb mg/l	Cl mg/l	SO4 mg/l	TDS mg/l	T-Fe mg/l
9/3/2014	6.45	18900	17.04	6296.36		96.83	146.13	0.008	18.41	5107.6			850	8832	15707	1.29
6/3/2014	6.75	18340	16.1	6297.3		92.16	136.64	0.01	13.99	4555.7			762	8988	15507	0.4
3/18/2014	8.05	19430	15.68	6297.72		95.01	144.27	0.009	12.83	4369.7			772	8015	15450	0.56
12/5/2013	7.72	19880	15.5	6297.9		96.81	145.75	0.01	14.06	4447.5			837	8849	15378	1.34
9/6/2013	8.17	19000	15.3	6298.1		91.84	134	0.009	16.69	4630.1			897	9615	15410	0.99
6/6/2013	7.14	16920	15.3	6298.1		96.27	141.67	0.008	15.36	4755.3			813	8841	15456	0.32
3/13/2013	6.97	17730	15.38	6298.02		99.98	151.81	0.009	17.17	4697.8			753	8829	15442	0.44
12/4/2012	7.6	17300	14.62	6298.78		98.42	151.56	0.01	25.11	4780.8			829	9159	15415	0.36
9/10/2012	6.45	16450	14.04	6299.36		104.09	151.87	< .002	15.11	5010.9			758	9030	15633	1.11
6/14/2012	7.64	17000	13.4	6300		106.74	160.45	0.01	13.31	4695.9			747	8546	15490	1.65
3/13/2012	4.86	15760	12.81	6300.59		107.29	158.22	0.01	13.32	4933.1			753	8616	15819	0.18
12/6/2011	6.19	16140	12.9	6300.5		103.47	164.86	< .002	16.11	4990.7			784	9854	15800	1.06
9/7/2011	6.52	17260	12.2	6301.2		105.62	160.5	0.013	15.67	4775.7			813	10058	15952	2.6
6/20/2011	7.9	16950	12.1	6301.3		101.38	159.56	0.012	17.47	5036.7			841	9447	15930	0.66
3/23/2011	7.66	17430	11.98	6301.42		106.25	165.16	0.011	15.72	4955.6			952	10522	16069	0.99
12/7/2010	7.66	17100	13.4	6300		99.89	145.95	0.011	28.13	4739.6			802	10146	16242	0.49
9/20/2010	7.14	17200	12.8	6300.6		106.97	160.46	0.013	15.84	4799.6			822	9872	16658	1.4
6/9/2010	7.58	17580	12.71	6300.69		111.3	169.41	0.012	15.3	5110.4			787	9816	16575	0.82
3/17/2010	7.79	17009	12.8	6300.6		114.15	181.38	0.002	16.26	5193.1			775	9706	16537	0.5
12/2/2009	7.97	17960	13.5	6299.9		109.51	181.71	0.01	16.18	4976.8			805	10152	16486	0.64
9/9/2009	6.95	18950	12.57	6300.83		116.19	193.79	0.013	14.51	5062.3			760	9652	16267	3.22
6/18/2009	7.09	17580	11.8	6301.6		117	187.36	0.012	15.73	4832			801	9892	16432	1.15
3/24/2009	7.76	17160	11.43	6301.97		116.43	195.44	0.012	17.25	4893.5			736	9567	16228	2.21
12/4/2008	7.64	18300	10.34	6303.06		116.5	189.37	0.01	15.36	5028.7			725	9891	16497	0.38
9/23/2008	7.49	19410	11.52	6301.88		113.28	181.39	0.013	16.39	4851.9			711	9690	16454	2.12
6/18/2008	8	17590	10.12	6303.28		116.55	188.4	< .002	12.65	4819			745	9816	16263	2.82
3/24/2008	7.53	17890	8.5	6304.9		110	180	0.02	16.59	5141			730	9836	16032	2.28
12/5/2007	5.5	16460	10.9	6302.5		102.45	160.06	0.018	16.54	5278.8			798	10459	16768	4.15
9/19/2007	7.6	19910	10.2	6303.2		111	189	0.013	18.2	4890			745	9988	16739	1.32
6/29/2007	7.76	17180	9.3	6304.1		123	168	0.018	11.7	4840			741	10298	17065	1.99
3/26/2007	7.65	18360	9.92	6303.48		120	4.54	< .002	7.67	5260			757	10807	16844	2.27
12/7/2006	7.83	18610	8.96	6304.44		121.77	175.8	0.02	17.66	5302.2			686	10287	16796	3.48
9/27/2006	7.96	18260	7.56	6305.84		113.2	149.36	0.02	9.83	5036.2			668	9739	17226	26.02
6/22/2006	7.35	18530	5.63	6307.77		118	160	0.044	14.6	4980			723	10507	17216	2.41
3/14/2006	7.28	15640	7.11	6306.29		114	171	0.019	20.7	4980			743	10200	17097	3.94
12/13/2005	7.32	13400	5.92	20693.83		95	119	0.02	12.5	5090			720	10300	17109	1.97
9/23/2005	7.05	16680	7.98	6305.42		106	147	0.011	13.1	4970			710	10630	16977	0.96
6/22/2005	9.4	17100	3.62	6309.78		110	146	0.015	6.12	5050			719	10970	16599	1.68
3/21/2005	8.63	16800	4.4	6309		103	139	0.03	23.3	5100			622	10060	16859	0.65
12/14/2004	8.5	17200	4.98	6308.42		98.3	136	0.009	13.6	4820			722	10830	16565	2.46
9/9/2004	8.37	17300	8.62	6304.78		97.9	133	0.009	15.3	4850	675	< 5.	688	11860	16844	1.31
6/3/2004	8.64	17500	24.02	6289.38		106	145	0.013	16.2	5200	683	< 5.	749	10990	17223	1.26
3/9/2004	8.9	17100	7.05	6306.35		112	150	0.014	29.6	5170	833	< 5.	876	10834	17561	3.57
12/9/2003	7.25	18200	10.06	6303.34		116	164	0.011	26.6	5250	825	< 5.	820	10272	17580	0.604
9/16/2003	8.19	18100	29.40	6284.00		115	159	0.011	24.9	5610	826	< 5.	939	11451	17143	1.23
6/26/2003	8.11	17900	8.54	6304.86		115	151	< .05	13.5	5170	788	< 5.	767	11302	17473	1.29
3/13/2003	7.93	17800	25.98	6287.42		117	157	0.011	14.3	5480	842	< 5.	732	10987	17635	0.28
12/5/2002	7.42	18200	22.90	6290.50		95	145	< .05	13	4500	789	< 5.	692	11317	17866	0.6
9/19/2002	8.25	21300	6.62	6306.78		106	159	< .05	14	5170	806	< 5.	780	10901	17680	0.8
6/25/2002	7.84	19300	26.05	6287.35		110	164	< .05	14	5365	811	< 5.	813	10717	17669	1.6
3/19/2002	7.66	20500	22.47	6290.93		108	158	< .05	13	5370	809	< 5.	753	11583	17936	0.6
12/13/2001	7.31	19300	6.50	6306.9		104	165	< .05	14	5360	792	< 5.	27.3	11668.6	18064	0.7
9/17/2001	7.96	800	6.94	6306.46		121	175	< .05	14	5850	805	< 5.	771.6	11447.3	18112	1.1
6/29/2001	7.16	21200	7.16	6306.24		110	162	< .05	13	5720	802	< 5.	570.6	7559	18400	1
3/13/2001	7.72	21000	5.32	6308.08		111	175	< .1	13	5810	806	< 5.	792	12167	18622	0.4
12/5/2000	7.58	22000	8.31	6305.09		120	166	< .1	14	5700	789	< 5.	762	11077	18772	0.7
3/4/1999	7.35	18800	6.04	6307.36		123	195	< .1	14	5890	788	< 5.	817	13073	19473	0.4
12/7/1998	7.36	20800	6.02	6307.38		128	197	< .1		6255	804	< 5.	1009	11940	19628	0.4
9/15/1998	7.54	21000	6.91	6306.49		126	179	< .1	13	6070	804	< 5.	291	11697	19925	0.3
6/9/1998	7.61	21000	7.00	6306.4		122	185	< .1	13	6340	816	< 5.	824	11811	19776	3
3/17/1998	7.89	22700		6305.9		111	167	< .1	13	6260	810	< 5.	840	12756	19930	0.9
12/15/1997	8.3	1890		6307.34		113	180	< .1	13	6530	817	< 5.	17	12786	19730	0.7
9/16/1997	7.76	1850	6.76	6306.641		127	185	< .1	11	5650	806	< 5.	865	12798	20060	0.7
6/26/1997	7.76	1810	5.71	6307.691		126	206	< .1	14	6850	800	< 5.	840	12595	20400	0.9
3/21/1997	7.77	1760	4.65	6308.751		126	199	< .1	13	6950	834	< 5.	815	12178	20770	1
12/16/1996	8.25	1820	5.51	6307.888		140	210	< .1	14	6660	684	< 5.	810	14898	20818	1.2
9/30/1996	8.07	1850	6.30	6307.101		133	42	< .1	14	6620	830	< 5.	80	13959		0.9
6/13/1996		< 1100.		6307		4	2	< .1	1	517	827	< 5.	846	13249	21506	1.6
4/2/1996	7.97	19400	5.18	6308.216		150	216	< .04	12.3	6310	770	< 2.	620	13123	21406	1.09
12/14/1995	7.97	18300	5.45	6307.954	55						800	< 5.	756	13144	21710	0.5
9/18/1995	7.78	1860	6.89	6306.51	10						750	< 5.	884	11705	21760	0.6
6/30/1995			5.15	6308.249	25						740	15	1200	14000	21920	0.9
3/29/1995	7.99	20800	5.22	6308.183	20						725	< 5.	870	13000	21800	1.2
12/19/1994	7.73	2070	5.61	6307.79	33						705	< 5.	940	12200	21880	1.1
9/16/1994	7.6	2100	5.51	6307.888	16						781	< 1.	777	11000	22280	0.9
6/22/1994	7.86	2160	4.82	6308.577	53						719	< 1.	822	13000	22880	1.2
3/23/1994			5.02	6308.38	62						820	2	206	13000	21700	1.1
12/17/1993	8.21	17900	4.53	6308.872	42						626	< 1.	850	13000	21791	1.3

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HISTORIC DATA COLLECTED FROM WELL DCWR1
(Data downloaded from the Utah Division of Oil, Gas and Mingin web site, 28 Jan 2015)

DATE	Field pH pH units	Cond (Field) umhos/cm	Depth feet	WL feet	TSS mg/l	D-Ca mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Na mg/l	Bicarb mg/l	Carb mg/l	Cl mg/l	SO4 mg/l	TDS mg/l	T-Fe mg/l
9/28/1993	7.78	17300	4.53	6308.872	30						807	< 1.	872.1	12000	22324	1
7/1/1993			4.72	6308.676	57						777	0	954.3	13000	22789	0.59
3/23/1993			4.90	6308.413												
3/17/1993			3.81	6309.594	54						767	0	992.5	1500	23169	0.19
12/21/1992			6.17	6307.232	197						673	0	930	18000	22218	2.12
9/3/1992	7.66	20000	5.81	6307.593	16						808	0	865	17000	22790	1.74
6/25/1992	7.52	20100	6.99	6306.412	219						765	0	870	17000	22705	1.17
3/20/1992			4.49	6308.905	20						749	0	885	18000	22860	0.36
12/12/1991	7.83	19900	5.61	6307.79	155						744	0	1000	13000	20210	1.26
9/10/1991	7.58	20600	7.48	6305.92	126						758	< 1.	895	18000	23040	2.13
6/11/1991	7.63	21000	6.43	6306.97	139						733	< 1.	900	600	13000	1.32
3/28/1991			5.41	6307.987	175						773	< 1.	835	15000	23845	2.64
12/14/1990			4.89	6308.512												
12/14/1990	7.17				114						935	< 1.	915	10000	18954	0.62
9/25/1990	7.15		4.00	6309.397	227						772	< 1.	1140	12800	24189	2.52
9/25/1990			4.00	6309.397												
6/14/1990	7.12				125						731	< 1.	1115	11000	21623	0.22
6/13/1990			5.22	6308.183												
3/6/1990			2.99	6310.414	24						884	< 1.	980	10500	11466	0.17
12/6/1989	7.34		3.61	6309.791	54						698	< 1.	645	12000	21671	0.08
12/6/1989			5.09	6308.315												
9/21/1989			5.91	6307.494												
8/25/1989			5.91	6307.494												
5/19/1989			5.41	6307.987												

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APPENDIX 7-3

Data from, USGS Gaging Station
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Available data for this site Time-series: Monthly statistics GO

Emery County, Utah
Hydrologic Unit Code 14060009
Latitude 39°22'17", Longitude 111°03'47" NAD27
Drainage area 187.00 square miles
Gage datum 6,210.00 feet above NGVD29

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00060, Discharge, cubic feet per second,												
YEAR	Monthly mean in ft3/s (Calculation Period: 1909-06-01 -> 1979-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1909						740.6	190.5	107.2	102.0	35.0		
1910	45.9	52.3	81.1	326.4	654.7	164.5		32.6	56.4	39.9	34.0	32.9
1911			49.5	79.3	299.7	275.0	121.2	62.5	36.8			
1912			23.6	42.7	269.2	487.8	127.3	85.4	47.9	36.0		
1913				157.3	376.4	217.9	126.4	70.9	69.6	46.8	43.2	47.6
1914	52.4	42.3	52.8	134.4	763.9	474.2	144.5	102.1	55.7	56.7	40.7	30.3
1915	34.6	31.8	43.9	125.0	223.7	236.5	124.0	63.4	41.8	41.0	39.2	38.9
1916	38.6	35.8	54.6	128.2	549.4	480.0	141.4	117.7	54.5	56.2	35.9	35.4
1917	25.0	30.0	44.8	92.6	418.0	778.6	226.9	101.5	67.7			
1920				42.3	569.4	452.1				43.6	44.9	
1921				88.8	635.8	766.5	184.4	155.4	94.9	62.8	51.3	40.0
1922	45.0	45.0	50.9	77.5	520.0	553.2	173.0	122.5	51.8	17.5	29.4	45.6
1923	48.4	45.0	50.0	82.3	501.8	329.0	180.6	92.4	52.5	47.1	42.0	
1924				75.1	192.2	98.3	64.0	35.2	40.3	32.4	33.0	25.5
1925	27.6	28.4	35.3	104.0	209.0	121.9	96.5	67.4	35.2	34.6	30.8	

1926			41.7	131.9	327.4	148.7	91.5	50.1	32.0	32.9	29.2	30.1
1927	32.0	34.0	34.6	68.6	379.7	259.9	111.7	88.9	78.6	35.1	34.9	27.0
1928	27.0	27.0	37.0	92.0	549.6	228.3	124.8	53.2	34.6	37.9	32.1	27.0
1929	27.0	30.0	40.0	45.3	364.6	368.3	148.5	90.5	78.9	46.3		35.0
1930	30.0		41.8	138.2	235.2					49.8	35.9	
1931		30.5	34.4	71.2	136.5	86.6	69.9	30.7	25.6	23.3	26.9	
1932			27.6	81.3	327.3	259.6	122.5	66.2	26.9			
1933				41.1	173.5	469.7	126.3	57.7	30.3	27.4		
1934		29.0	31.2	81.6	72.0	51.1	20.7	19.3	19.5	21.8	21.9	
1935		23.1	26.4	48.1	223.8	394.1	128.7	60.6	26.2	23.3	24.3	22.3
1936		27.1	28.8	130.6	579.5	278.9	112.8	80.3	50.0	33.8	26.9	
1937			28.5	66.3	471.7	230.2	113.3	88.8	51.6	42.0	28.2	31.5
1938	29.2	29.3	31.7	115.3	326.2	258.3	128.0	73.1	37.7	33.3	32.0	
1939			38.8	128.4	212.6	140.5	103.0	40.2	31.9	28.9	23.7	20.5
1940	19.0	23.0	27.9	72.3	373.8	158.1	100.5	35.6	36.0	31.1	25.7	26.6
1941	24.0	26.4	30.0	41.4	525.4	370.7	160.3	77.6	69.9	62.3	43.8	35.5
1942	33.0	30.0	34.2	139.6	371.7	378.4	152.4	80.9	39.1	36.7	35.4	33.5
1943	32.0	31.7	33.3	178.4	211.2	211.0	122.2	74.1	33.3	36.0	27.7	28.2
1944	23.0	25.0	32.9	45.0	450.0	479.9	159.4	101.6	40.7	37.2	34.9	30.0
1945	28.0	28.7	35.4	53.0	304.9	239.3	145.6	94.4	47.6	36.5	32.9	28.0
1946	26.0	25.0	34.7	173.3	224.4	167.2	121.7	52.2	28.5	43.2	32.5	28.7
1947	27.7	30.7	35.8	91.5	354.2	200.3	153.9	92.6	39.9	39.4	36.5	37.6
1948	32.0	32.0	31.5	51.9	224.1	132.2	100.0	52.5	28.5	31.0	28.4	25.5
1949	24.0	25.0	31.3	107.2	348.3	319.1	177.3	121.0	56.7	40.8	31.4	24.1
1950	23.3	27.8	31.5	98.8	251.5	194.5	148.7	104.5	47.1	34.4	31.3	29.6
1951	27.0	23.9	29.6	82.7	266.1	260.5	171.6	91.2	64.4	38.2	27.8	25.4
1952	25.6	32.4	35.0	123.8	850.0	776.5	251.0	169.0	131.3	67.9	43.0	40.0
1953	37.0	39.3	46.5	79.4	184.6	318.2	187.2	102.2	73.0	41.9	33.2	29.3
1954	28.2	35.3	37.0	91.7	150.1	122.2	75.9	46.5	33.2	29.3	23.7	21.2
1955	19.1	21.4	24.3	38.3	168.4	156.1	138.2	67.1	28.3	26.6	21.5	24.5
1956	26.2	24.7	29.9	87.7	229.8	159.7	157.9	58.7	27.4	25.8	19.6	19.0
1957	19.0	22.5	23.7	37.6	226.4	587.0	206.3	116.0	92.4	77.5	37.3	32.8
1958	30.0	31.9	34.4	95.2	610.9	412.1	182.8	150.2	47.8	38.7	25.8	26.4
1959	25.3	26.7	28.9	53.0	106.6	93.5	93.4	63.9	26.2	26.0	21.3	20.0
1960	19.1	21.2	25.5	57.6	156.3	130.2	131.7	64.1	24.2	25.3	21.7	19.9
1961	18.0	18.4	21.2	43.1	103.3	81.4	86.9	40.8	33.9	23.5	23.6	17.1
1962	12.3	23.6	27.7	123.2	378.1	308.6	171.4	160.8	51.6	35.5	28.2	19.6
1963	12.7	25.5	26.3	39.3	202.1	126.0	147.4	101.5	36.6	32.6	17.8	14.5
1964	17.0	19.0	19.7	34.0	238.2	178.0	139.1	134.7	26.7	23.0	21.4	21.0
1965	22.8	24.9	26.0	52.1	300.0	525.1	228.9	173.6	125.4	60.8	35.1	36.1
1966	33.3	28.0	37.7	115.3	186.8	141.5	112.7	76.0	56.8	34.5	25.0	20.9

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1967	20.2	18.4	31.0	42.3	244.9	344.5	162.3	121.9	72.6	46.2	24.2	21.1
1968	19.7	23.4	30.9	51.1	267.5	434.9	137.7	70.2	86.8	67.9	31.8	25.8
1969	26.0	27.4	32.6	120.9	551.9	284.7	132.8	88.4	58.6	61.8	32.0	30.3
1970	29.5	34.4	34.1	70.8	363.2	378.1	145.5	97.3	80.1	55.7	36.7	32.5
1971	30.0	32.7	38.5	105.5	240.3	262.6	139.0	114.3	62.9	49.9	31.1	28.0
1972	27.3	31.8	47.3	94.6	189.0	140.5	91.4	69.5	45.1	43.1	28.2	26.0
1973	22.3	29.4	31.7	57.9	562.8	436.2	116.9	110.2	82.1			
1977										16.9	19.8	16.3
1978	19.5	22.1	23.5	39.4	171.9	379.1	134.0	120.4	60.1	24.4	24.9	25.5
1979	30.3	28.9	29.7	58.1	185.7	195.7	117.7	120.8	83.8			
Mean of monthly Discharge	28	29	35	88	333	304	137	86	53	39	31	28

** No Incomplete data have been used for statistical calculation

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USGS Annual Statistics for the Nation

The statistics generated from this site are based on approved daily-mean data and may not match those published by the USGS in official publications. The user is responsible for assessment and use of statistics from this site. For more details on why the statistics may not match, click here.

USGS 09318000 HUNTINGTON CREEK NR HUNTINGTON, UTAH

Available data for this site Time-series: Annual statistics GO

Emery County, Utah Hydrologic Unit Code 14060009 Latitude 39°22'17", Longitude 111°03'47" NAD27 Drainage area 187.00 square miles Gage datum 6,210.00 feet above NGVD29	**Output formats** HTML table of all data Tab-separated data Reselect output format

Water Year	00060, Discharge, cubic feet per second
1909	318.3
1910	153.3
1911	103.0
1912	154.3
1913	135.1
1914	164.2
1915	87.9
1916	143.5

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Water Year	00060, Discharge, cubic feet per second
1917	159.5
1919	182.8
1920	299.2
1921	239.8
1922	149.9
1923	123.5
1924	74.5
1925	68.3
1926	98.7
1927	98.8
1928	106.4
1929	107.9
1930	92.7
1931	57.3
1932	106.4
1933	139.9
1934	38.9
1935	96.7
1936	123.4
1937	122.1
1938	94.6
1939	82.3
1940	76.9
1941	118.1
1942	117.1
1943	86.2
1944	121.0
1945	90.4
1946	79.4
1947	94.8

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Water Year	00060, Discharge, cubic feet per second
1948	66.8
1949	108.4
1950	85.7
1951	93.1
1952	207.5
1953	101.7
1954	60.5
1955	61.6
1956	73.1
1957	116.3
1958	146.2
1959	50.9
1960	58.3
1961	43.0
1962	110.6
1963	67.2
1964	73.0
1965	129.0
1966	77.0
1967	95.2
1968	101.0
1969	121.5
1970	113.4
1971	96.2
1972	70.6
1973	129.5
1978	85.3
1979	77.4
1980	35.5

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Water Year	00060, Discharge, cubic feet per second
** Incomplete data have been used for statistical calculation	

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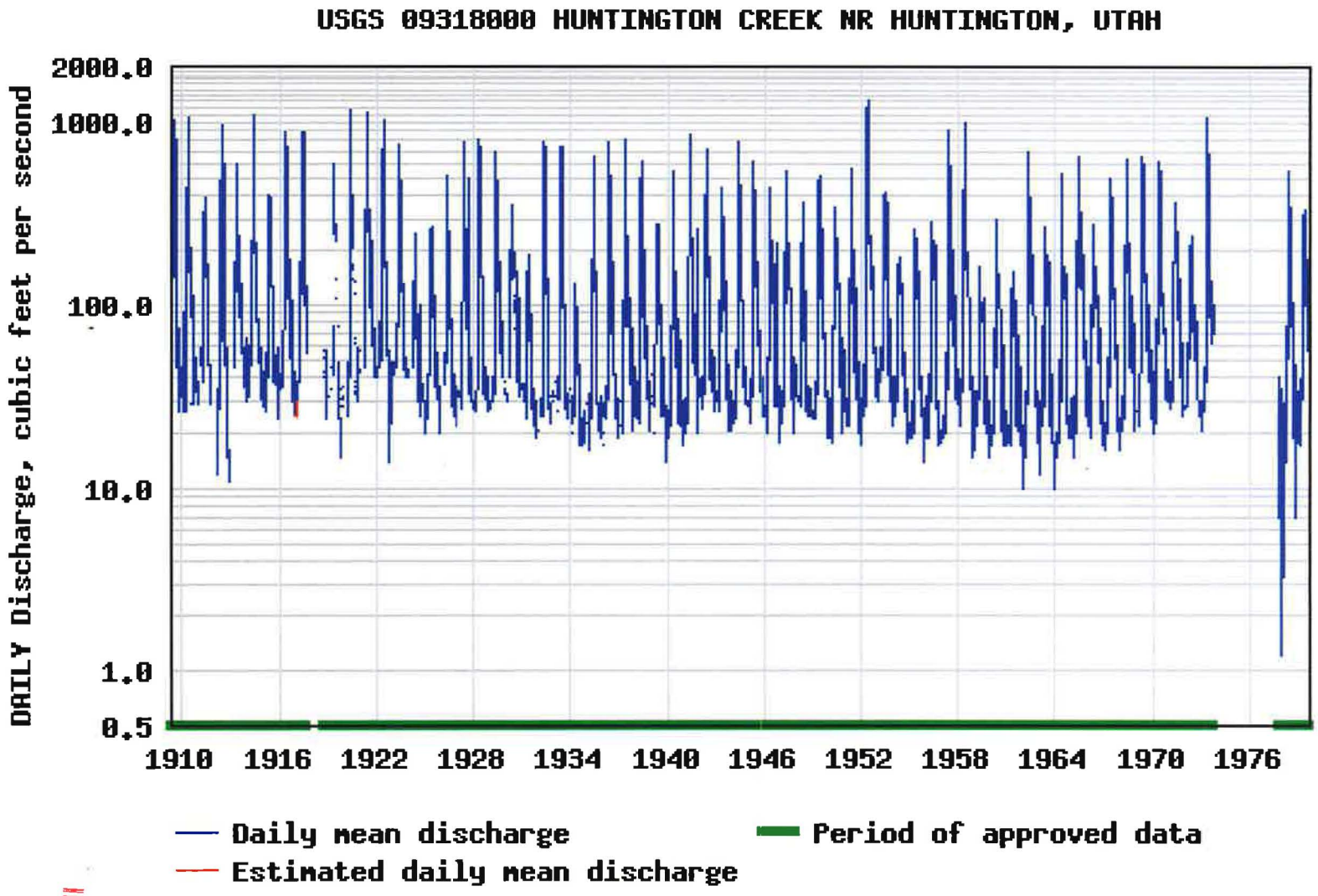

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Peak Streamflow for the Nation

USGS 09318000 HUNTINGTON CREEK NR HUNTINGTON, UTAH

Available data for this site Surface-water: Peak streamflow GO

Emery County, Utah
Hydrologic Unit Code 14060009
Latitude 39°22'17", Longitude 111°03'47" NAD27
Drainage area 187.00 square miles
Gage datum 6,210.00 feet above NGVD29

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Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1909	Aug. 18, 1909	6.00[3]	1,390[5]
1910	May 05, 1910	5.90[3]	1,070[5]
1911	May 24, 1911	4.20[3]	409[5]
1912	Jul. 26, 1912	5.80[3]	1,200[5]
1913	May 11, 1913	5.10[3,6]	798[5]
1914	May 23, 1914	6.15[3]	1,290[5]

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Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1915	Jun. 01, 1915	4.68[3]	606[5]
1916	May 08, 1916	5.60[3]	1,100[5]
1917	May 17, 1917	5.58[3]	888[5]
1918	Jun. 19, 1918	5.60[6]	1,160[5]
1919	May 02, 1919	4.86	790[5]
1920	May 24, 1920	5.33	1,340[5]
1921	May 16, 1921	5.38	1,380[5]
1922	May 25, 1922	5.29	1,340[5]
1923	May 20, 1923	4.70	907[5]
1924	May 03, 1924	3.34	308[5]
1925	Aug. 25, 1925	4.70	870[5]
1926	Sep. 11, 1926	4.45	755[5]
1927	Sep. 10, 1927	6.90	2,000[5]
1928	May 09, 1928	4.80	980[5]
1929	May 24, 1929	4.62	830[5]
1930	Aug. 02, 1930	7.50	2,500[5]
1931	May 16, 1931	2.65	262[5]
1932	May 21, 1932	3.75	1,060[5]
1933	Jun. 01, 1933	3.75	1,030[5]
1934	Aug. 09, 1934	3.08	542[5]
1935	Jun. 07, 1935	3.57	826[5]
1936	May 14, 1936	3.80	980[5]
1937	Jul. 08, 1937	4.52	1,630[5]
1938	Aug. 08, 1938	4.15	1,260[5]
1939	May 03, 1939	2.94	338[5]
1940	Aug. 06, 1940	3.98	761[5]
1941	May 12, 1941	4.30	1,050[5]
1942	May 27, 1942	4.00	851[5]
1943	Jun. 01, 1943	3.65	694[5]
1944	May 15, 1944	4.06	1,020[5]

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Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1945	May 11, 1945	4.24[1]	925[5]
1946	Jul. 24, 1946	6.14[1]	2,300[5]
1947	May 05, 1947	3.71	740[5]
1948	May 18, 1948	3.23	462[5]
1949	Jun. 12, 1949	3.43	562[5]
1950	May 16, 1950	3.09	420[5]
1951	Aug. 23, 1951	3.97	800[5]
1952	Jun. 04, 1952	6.10	1,580[5]
1953	Jul. 10, 1953	6.23	1,650[5]
1954	Jul. 13, 1954	3.53	257[5]
1955	May 11, 1955	3.89	338[5]
1956	Jul. 30, 1956	8.20[1,5]	1,940[5]
1957	Jun. 06, 1957	5.47	1,170[5]
1958	May 23, 1958	5.38	1,180[5]
1959	Aug. 01, 1959	3.41[2]	227[5]
1960	May 12, 1960	4.10	442[5]
1961	Aug. 05, 1961	7.10	2,120[5]
1962	May 08, 1962	4.98	842[5]
1963	Aug. 04, 1963	4.28	510[5]
1964	May 21, 1964	4.77	766[5]
1965	May 21, 1965	4.81	766[5]
1966	Jul. 11, 1966	3.97	387[5]
1967	Sep. 09, 1967	4.83	782[5]
1968	Jul. 30, 1968	6.33	1,640[5]
1969	May 13, 1969	4.71	777[5]
1970	May 19, 1970	4.83	817[5]
1971	May 17, 1971	4.22	489[5]
1972	May 30, 1972	3.56	264[5]
1973	May 21, 1973	5.12	1,080[5]
1974	May 09, 1974	3.17	361[5]

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Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1975	Jul. 09, 1975	5.08	910[5]
1976	Jul. 18, 1976	3.52	253[5]
1977	Jul. 23, 1977		241[5]
1978	Jun. 10, 1978	4.42	591[5]
1979	Aug. 13, 1979	4.84	684[5]

?

Peak Gage-Height Qualification Codes.

- 1 -- Gage height affected by backwater
- 2 -- Gage height not the maximum for the year
- 3 -- Gage height at different site and(or) datum
- 5 -- Gage height is an estimate
- 6 -- Gage datum changed during this year

?

Peak Streamflow Qualification Codes.

- 5 -- Discharge affected to unknown degree by Regulation or Diversion

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APPENDIX 7-4

Climatological Data

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CASTLE DALE, UTAH (421214)

Period of Record Monthly Climate Summary

Period of Record : 02/08/1899 to 12/31/2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	35.2	41.9	53.2	62.5	72.2	82.8	88.5	85.8	77.6	65.2	50.1	37.9	62.8
Average Min. Temperature (F)	6.7	14.3	23.5	30.7	38.6	46.5	53.4	51.3	42.1	31.5	20.4	10.7	30.8
Average Total Precipitation (in.)	0.60	0.56	0.52	0.54	0.64	0.46	0.77	1.05	0.87	0.84	0.51	0.53	7.89
Average Total SnowFall (in.)	5.9	3.2	1.3	0.3	0.2	0.0	0.0	0.0	0.0	0.1	1.0	4.0	16.0
Average Snow Depth (in.)	5	5	4	4	4	4	4	4	4	3	4	4	4

Percent of possible observations for period of record.
Max. Temp.: 81.3% Min. Temp.: 81.4% Precipitation: 89.6% Snowfall: 85.8% Snow Depth: 67.1%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

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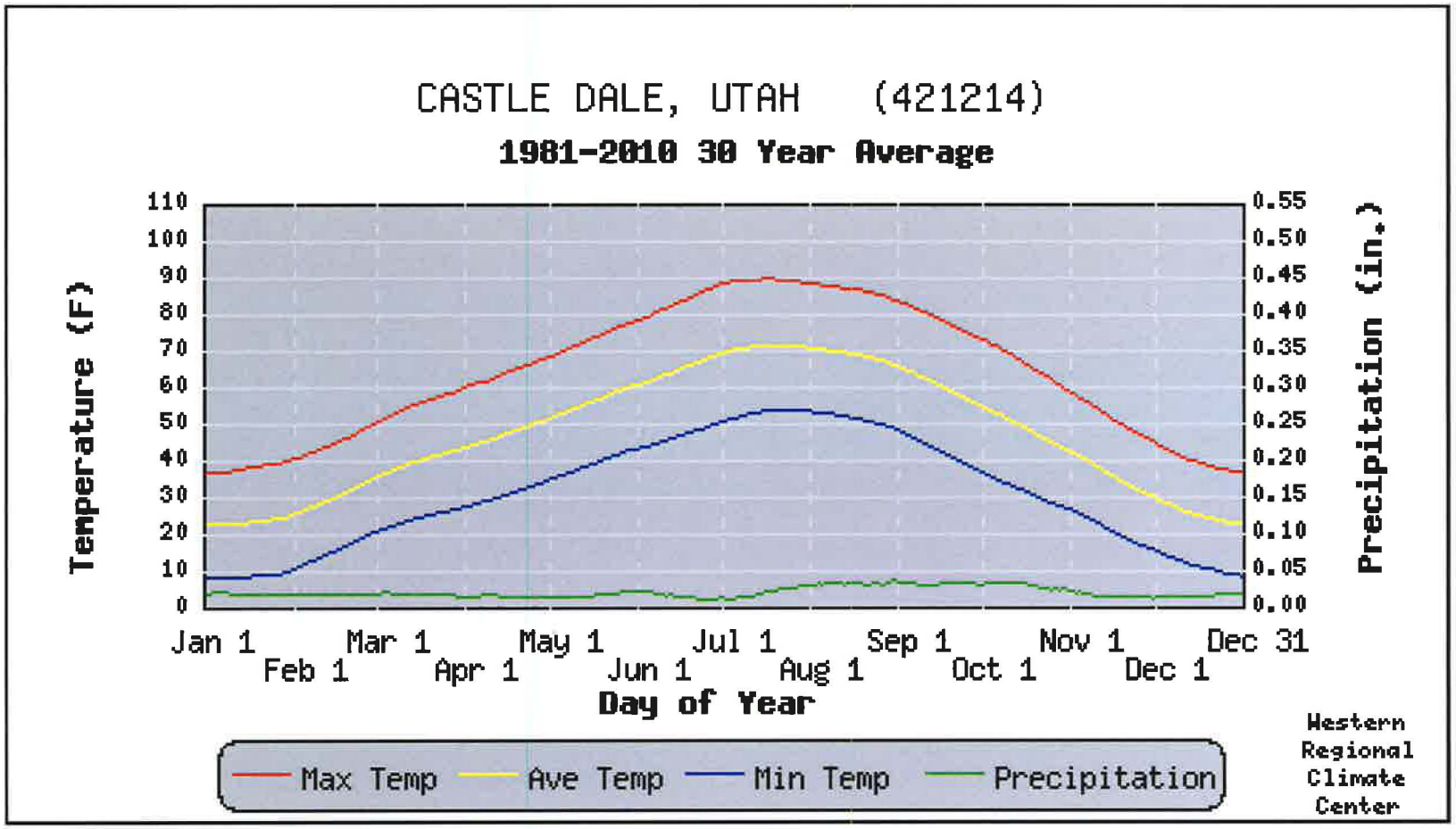

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CASTLE DALE, UTAH

Period of Record General Climate Summary - Temperature

Station:(421214) CASTLE DALE

From Year=1899 To Year=2012

	Monthly Averages				Daily Extremes			Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	# Days	# Days
January	35.2	6.7	20.8	67	31/2003	-34	22/1937	34.6	2003	-2.4	1937	0.0	11.9	30.7	9.3
February	41.9	14.3	28.1	70	26/1986	-35	10/1933	39.8	1995	5.3	1933	0.0	4.3	27.7	3.3
March	53.2	23.5	38.4	83	21/2004	-7	03/1922	46.3	2004	29.6	1917	0.0	0.3	27.6	0.1
April	62.5	30.7	46.6	89	26/1910	-6	27/1902	54.7	1943	39.3	1933	0.0	0.0	17.8	0.0
May	72.2	38.6	55.4	97	28/2003	13	11/1922	61.3	1969	48.1	1933	0.3	0.0	5.7	0.0
June	82.8	46.5	64.7	103	25/1994	25	01/1919	71.2	1918	58.1	1904	6.8	0.0	0.5	0.0
July	88.5	53.4	71.0	107	13/2002	29	06/1902	75.4	2003	65.9	1904	15.3	0.0	0.0	0.0
August	85.8	51.3	68.6	106	13/2007	30	21/1904	73.3	1994	62.7	1927	9.4	0.0	0.0	0.0
September	77.6	42.1	59.9	97	14/2000	19	16/1903	66.1	1899	54.7	1986	1.4	0.0	2.9	0.0
October	65.2	31.5	48.4	88	02/1899	3	30/1971	54.7	2003	41.3	1905	0.0	0.0	17.4	0.0
November	50.1	20.4	35.3	85	14/1910	-10	30/2004	41.6	1914	25.9	1938	0.0	0.8	28.2	0.2
December	37.9	10.7	24.6	67	04/1995	-28	27/1909	34.4	1980	10.3	1924	0.0	8.3	30.4	4.7
Annual	62.8	30.8	46.8	107	20020713	-35	19330210	50.5	1981	42.1	1932	33.2	25.6	189.0	17.6

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Winter	38.3	10.5	24.5	70	19860226	-35	19330210	33.9	1981	7.4	1933	0.0	24.5	88.8	17.3
Spring	62.7	31.0	46.8	97	20030528	-7	19220303	51.2	2004	39.5	1917	0.3	0.3	51.1	0.1
Summer	85.7	50.4	68.1	107	20020713	25	19190601	72.7	1994	62.8	1904	31.5	0.0	0.6	0.0
Fall	64.3	31.3	47.9	97	20000914	-10	20041130	51.9	1963	43.5	1930	1.4	0.8	48.5	0.2

Table updated on Oct 31, 2012
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

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CASTLE DALE, UTAH

Period of Record General Climate Summary - Precipitation

Station:(421214) CASTLE DALE

From Year=1899 To Year=2012

	Precipitation											Total Snowfall		
	Mean	High	Year	Low	Year	1 Day Max.	>= 0.01 in.	>= 0.10 in.	>= 0.50 in.	>= 1.00 in.	Mean	High	Year
	in.	in.	-	in.	-	in.	dd/yyyy or yyyymmdd	# Days	# Days	# Days	# Days	in.	in.	-
January	0.60	2.32	1993	0.00	1931	1.00	20/1904	4	2	0	0	5.9	24.5	1980
February	0.56	2.04	1998	0.00	1906	1.10	07/1965	4	2	0	0	3.2	19.9	1978
March	0.52	1.93	1981	0.00	1909	1.10	13/1996	3	2	0	0	1.3	13.5	2006
April	0.54	2.71	1906	0.00	1899	0.92	17/1988	4	2	0	0	0.3	6.0	1973
May	0.64	2.73	1941	0.00	1899	1.65	27/1993	4	2	0	0	0.2	4.0	1905
June	0.46	2.25	1910	0.00	1902	1.40	28/1910	3	2	0	0	0.0	0.0	1902
July	0.77	3.21	1936	0.00	1909	1.43	23/1977	5	2	0	0	0.0	0.0	1908
August	1.05	3.27	1961	0.00	1940	2.15	28/2007	6	3	0	0	0.0	0.0	1908
September	0.87	3.68	1961	0.00	1901	1.70	30/1911	4	2	0	0	0.0	0.0	1901
October	0.84	3.80	2006	0.00	1902	1.51	06/2006	4	2	0	0	0.1	4.0	1984
November	0.51	2.68	1978	0.00	1901	1.75	21/1905	3	1	0	0	1.0	12.1	1983
December	0.53	2.08	1909	0.00	1901	1.20	29/1915	4	2	0	0	4.0	18.4	1983
Annual	7.89	14.28	1965	3.29	1934	2.15	20070828	47	25	3	0	16.0	52.8	1983
Winter	1.69	4.90	1993	0.00	1961	1.20	19151229	11	6	1	0	13.1	42.0	1937
Spring	1.70	4.28	1906	0.01	1955	1.65	19930527	11	6	1	0	1.8	13.5	2006
Summer	2.28	5.91	1965	0.26	1956	2.15	20070828	14	7	1	0	0.0	0.0	1928
Fall	2.22	5.58	1905	0.11	1935	1.75	19051121	11	6	1	0	1.1	12.1	1983

Table updated on Oct 31, 2012
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

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STATION: PRICE-CARBON COUNTY AIRPORT (KPUC), UT

CLIMATOLOGICAL SUMMARY. Period of Record: Sep 1998 to Dec 2008

Summaries based on unedited daily ASOS data. Errors may be present.

TEMPERATURE (F)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Avg Max Temp	36.3	41.0	52.7	61.7	73.0	83.7	91.8	86.4	76.3	62.8	48.0	35.8	62.5
Avg Min Temp	16.4	20.8	27.8	34.0	43.1	51.6	60.4	57.0	47.4	37.6	25.8	15.6	36.5
Avg Temperature	26.3	30.9	40.2	47.8	58.0	67.7	76.1	71.7	61.9	50.2	36.9	25.7	49.5
Extremes:													
Extreme Max Temp	55	59	77	83	95	98	102	99	92	83	66	54	102
Date of Ext-Day	19	25	21	30	30	30	09	20	01	01	01	27	
-Year	2000	1999	2004	2007	2002	2002	2002	2007	2007	2000	1999	1999	
Extreme Min Temp	-7	1	2	14	25	31	47	44	28	21	0	-3	-7
Date of Ext-Day	15	10	02	10	11	13	04	28	30	17	30	28	
-Year	2007	2004	2002	1999	1999	2001	2000	2004	2007	1999	2004	2007	
Heating Degree Days	1198	963	768	515	245	55	0	4	129	461	844	1218	6401
Cooling Degree Days	0	0	0	0	30	135	345	212	35	1	0	0	758
Avg Number of Days:													
Max Temp >= 90	0.0	0.0	0.0	0.0	1.0	9.0	21.7	9.9	0.6	0.0	0.0	0.0	42.2
Max Temp >= 75	0.0	0.0	0.4	2.0	15.9	25.3	30.9	30.0	18.5	3.3	0.0	0.0	126.3
Max Temp <= 32	10.5	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	11.8	27.3
Min Temp <= 32	30.6	27.7	23.8	11.1	2.7	0.1	0.0	0.0	0.6	6.8	24.7	30.9	159.1
Min Temp <= 20	20.7	12.1	4.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	6.5	21.7	66.6
Min Temp <= 0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	2.3
Avg Dew Point Temp	16.1	18.2	20.0	22.7	28.3	32.3	40.4	42.1	33.8	27.9	19.9	14.7	26.4
Avg Wet Bulb Temp	22.7	26.2	32.1	37.1	44.1	50.0	56.3	54.9	47.7	39.8	29.9	21.9	38.6
Avg Sea Level Pres (Inches of Mercury)	30.27	30.17	30.07	29.97	29.93	29.90	29.88	29.92	29.99	30.08	30.21	30.27	30.06

WEATHER See disclaimer below	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Avg Number of Days:													
Thunderstorms	0.0	0.3	1.0	2.2	2.6	5.2	9.2	10.4	4.6	2.5	0.4	0.0	38.4
Heavy Fog	2.5	2.8	0.9	0.3	0.1	0.0	0.1	0.0	0.0	0.4	0.9	1.6	9.5
Fog	6.2	6.7	4.0	3.9	1.4	1.7	0.8	2.1	2.9	4.6	3.6	5.4	43.4
Hail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PRECIPITATION (In)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Monthly	0.65	0.79	0.52	0.60	0.40	0.59	0.46	0.80	1.11	1.18	0.47	0.61	8.17
Maximum Daily	0.53	0.72	0.69	1.16	0.46	0.69	0.61	0.70	1.05	1.38	0.56	0.63	1.38
Date of Ext-Day	26	22	29	24	22	25	14	16	01	06	11	25	
-Year	2000	2008	2006	2005	2008	2005	1999	2005	1999	2006	2004	2006	
Avg Number of Days:													
>= 0.01	5.2	5.6	4.1	5.5	4.4	4.6	4.8	7.6	5.7	6.9	3.4	4.6	62.5
>= 0.10	2.3	3.0	1.6	2.3	1.1	1.4	1.7	2.8	2.4	3.0	1.8	2.1	25.6

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>= 0.25	0.8	1.0	0.7	0.3	0.5	0.8	0.6	0.6	1.3	1.3	0.7	0.7	9.3
>= 0.50	0.1	0.1	0.1	0.2	0.0	0.2	0.1	0.2	0.7	0.7	0.1	0.3	2.8
>= 1.00	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.5

WIND (MPH)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Avg Wind Speed	5.1	6.0	8.0	8.6	8.5	8.1	7.2	6.7	6.9	6.6	6.0	5.0	6.9
Daily Avg Max 2-Min	14.4	15.8	20.2	22.6	22.9	22.6	22.2	21.0	18.6	16.6	15.1	14.1	18.8
Daily Avg Peak Gust	17.3	19.6	25.8	29.2	30.0	29.4	28.4	26.9	23.8	20.9	18.5	17.0	23.9
Maximum Daily Avg	17.7	18.2	21.1	18.8	18.7	19.8	12.1	14.7	14.9	15.9	20.0	17.7	21.1
Maximum 2-Minute Avg	38	36	49	41	41	40	39	43	39	44	45	37	49
Date of Max 2min-Day	06	08	20	15	30	01	14	15	17	20	17	15	
-Year	2003	2002	2000	2002	1999	2002	2007	2001	2003	2007	1998	2003	
Maximum Peak Gust	44	46	64	61	71	60	53	56	47	58	54	49	71
Date of Max Gust-Day	06	17	20	29	30	06	17	07	17	20	17	15	
-Year	2003	1999	2000	2007	1999	2007	2000	2000	2003	2007	1998	2003	
Avg Number of Days:													
Peak Gust >=30	4.0	4.5	9.9	13.8	15.8	14.3	12.4	10.6	7.3	5.7	4.1	3.6	106.0
Peak Gust >=40	0.5	0.5	1.9	3.1	3.6	2.0	2.4	1.6	0.9	1.1	0.6	0.9	19.2
Peak Gust >=50	0.0	0.0	0.2	0.5	0.4	0.4	0.3	0.2	0.0	0.2	0.2	0.0	2.4
Max 2-Minute >=30	0.5	0.7	2.8	4.0	4.2	2.2	3.2	2.5	1.6	1.1	0.7	0.0	23.6
Max 2-Minute >=40	0.0	0.0	0.1	0.2	0.4	0.1	0.0	0.1	0.0	0.2	0.1	0.0	1.2

Observations of WEATHER may me innacurate due to early ASOS inconsistancies. Average days with Thunderstorms may be low due to early mis-detection.

Heavy Fog = Visibility less than or equal to 1/4 mile.
Fog = Visibility greater than 1/4 mile or less than 7 miles.
Peak Gust = Maximum 5-second average.
Snowfall data not observed at ASOS stations.

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APPENDIX 7-5

Sediment Yield Evaluation of
Reclaimed vs. Natural Conditions

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Pre- vs. Post-Disturbance
Sediment Yield Calculations
Using the Revised Universal Soil Loss Equation

Site: Deer Creek Waste Rock Site
Client: BRC Wellington

Pre-Disturbance Condition: Mancos shale residuum, highly erodible
Reclamation Summary: Subsoil and topsoil cover, deep gouging, mulched, revegetated

Sediment Yield Calculation

RUSLE Equation:

A = R K LS VM, where A is the annual sediment yield (tons/acre/year)

Factor	Value	Source
R (Rainfall erosivity)	10	Israelsen et al. (1984), Map R7
K (Soil erodibility)	0.10	Web Soil Survey (value for Gerst-Strych-Badland complex)
LS (Topographic factor)	See attached calculation spreadsheet	
VM (vegetative/mechanical)		
Pre-disturbance	1.000	Average of "bare soil conditions" presented by Haan et al. (1991)
Newly reclaimed	0.010	Israelsen et al. (1984), Figure 4, 2 tons/ac mulch
Successfully revegetated	0.220	Israelsen et al. (1984), Figure 7, 0% canopy of tall weeds with 17.5% grass cover (from study presented in Appendix 3-2, data collected on fill slope)

Vegetative Community	R	K	LS	VM	A (t/ac/yr)	
Pre-Disturbance						
Natural site conditions	10	0.10	1.37	1.000	1.369	100
Post-Reclamation						
Newly reclaimed	10	0.10	3.09	0.010	0.031	2.3
Successfully revegetated	10	0.10	3.09	0.220	0.679	49.6

Sediment yield as a % of pre-disturbance conditions

Reference:

Haan, C.T., B.J. Barfield, and J.C. Hayes. 1991. *Design Hydrology and Sedimentology for Small Catchments*. Academic Press. San Diego, California.

Israelsen, C. Earl, Joel E. Fletcher, Frank W. Haws, and Eugene K. Israelsen. 1984. *Erosion and Sedimentation in Utah: A Guide for Control*. Hydraulics and Hydrology Series UWRL/H-84/03. Utah Water Research Laboratory, College of Engineering, Utah State University, Logan, Utah.

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LS Calculation Table

Condition	s	l	m	LS
Pre-Disturbance	10.0	100	0.5	1.37
Post-Reclamation	50.0	3	0.5	3.09

Factor	Values		Source
	Pre Distrub	Post Reclaim	
s (slope angle %)	10	50	Based on a typical pre-disturance slope of 10% and the steepest reclaimed slope of 50% (i.e., the 2:1 outslope of the pile)
l (slope length)	100	3	This value is defined as the distance from the origin of ovcrland flowto thc point of deposition or channelized flow. For the pre-disturbace site, this is typical of the shortest distance to a rill. The post-reclamation length was assumed based on the typical distance from the top to the bottom of a gouge.
m (slope-based exponent	0.5	0.5	Israelsen et al. (1984), Appendix C

l = slope length (ft). This value is defined as the distance from the origin of overland flow to the point of deposition or channelized flow. Slope lengths rarely exceed 400 feet, and in this case, the presence of rocks, trees, and roads are conservatively estimated to limit thc prc-disturbancc slopc lcngth to 100 fcct. Post-reclamation slope lengths are taken as 3 feet, which is the average distance from the top to the bottom of a deep gouge.

m = a factor in the LS equation which is 0.5 for slopes steeper than

$$LS = ((65.41s^2/(s^2+10{,}000)) + 4.56s/(s^2+10{,}000)^{0.5} + 0.065) / (l/72.6)^m$$

(Israelsen et al., 1984)

References:

Israelsen, C. Earl, Joel E. Fletcher, Frank W. Haws, and Eugene K. Israelsen, 1984. *Erosion and Sedimentation in Utah: A Guide for Control*. Hydraulics and Hydrology Series UWRL/H-84/03. Utah Water Research Laboratory, College of Engineering, Utah State University, Logan, Utah.

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APPENDIX 7-6

Water Rights Information

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APPROPRIATED POINTS OF DIVERSION
SEC. 5, T. 17 S., R. 8 E.

(Data downloaded from the Utah Division of Water Rights Web site, 29 Jan 2015)

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Search of TOWNSHIP = '17S' and RANGE = '8E' and SECTION_NO = '05' and BEM = 'SL'

WR Number	Diversion Type	Well Log	Location	Status	Priority	Uses	CFS	ACFT	Address	Owner Name	Latitude	Longitude
93-2229	Surface		N760 0 SW 05 17S 8E SL	P	1879	IS	45.000	0.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461
93-2230	Surface		N760 0 SW 05 17S 8E SL	P	1884	IS	77.250	0.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461
93-2231	Surface		N760 0 SW 05 17S 8E SL	P	1888	IS	80.000	0.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461
93-2232	Surface		N100 E1270 SW 05 17S 8E SL	P	1879	IS	45.000	0.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	-111.054112301
93-2233	Surface		N100 E1270 SW 05 17S 8E SL	P	1884	IS	77.250	0.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	-111.054112301
93-2234	Surface		N100 E1270 SW 05 17S 8E SL	P	1888	IS	80.000	0.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	-111.054112301
93-224	Surface		N760 0 SW 05 17S 8E SL	P	1875	IS	150.000	0.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461
93-226	Surface		N100	P	1875	IS	150.000	0.000	P.O. BOX 327	HUNTINGTON	39.3668169133	-

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		E1270 SW 05 17S 8E SL							CLEVELAND IRRIGATION COMPANY		111.054112301
93-3195	Rediversion	N760 0 SW 05 17S 8E SL	P	19800228	DIMOSP	0.000	2000.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	- 111.058607461
93-3195	Rediversion	N100 E1270 SW 05 17S 8E SL	P	19800228	DIMOSP	0.000	2000.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	- 111.054112301
93-928	Rediversion	N760 0 SW 05 17S 8E SL	P	19160725	DIMOSP	0.000	600.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	- 111.058607461
93-928	Rediversion	N100 E1270 SW 05 17S 8E SL	P	19160725	DIMOSP	0.000	600.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	- 111.054112301
93-950	Rediversion	N760 0 SW 05 17S 8E SL	P	19210112	DIMOSP	0.000	465.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	- 111.058607461
93-950	Rediversion	N100 E1270 SW 05 17S 8E SL	P	19210112	DIMOSP	0.000	465.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	- 111.054112301
93-951	Rediversion	N760 0 SW 05 17S 8E SL	P	19220803	DIMOSP	0.000	9892.620	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	- 111.058607461
93-951	Rediversion	N100 E1270 SW 05 17S 8E SL	P	19220803	DIMOSP	0.000	9892.620	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	- 111.054112301
a15762	Rediversion	N760 0 SW 05 17S 8E SL	A	19900730	IMP	0.000	31264.000	ATTN: CARLY BURTON	PACIFICORP DBA UTAH POWER & LIGHT COMPANY	39.368627432	- 111.058607461

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a15762	Rediversion	N100 E1270 SW 05 17S 8E SL	A	19900730	IMP	0.000	31264.000	ATTN: CARLY BURTON	PACIFICORP DBA UTAH POWER & LIGHT COMPANY	39.3668169133	-111.054112301
93-216	Point to Point	N660 E660 SW 05 17S 8E SL	P	1902	S	0.000	0.000	HUNTINGTON UT 84528	EDWARD HARRISON	39.3683539463	-111.056271892
93-225	Point to Point	S660 W660 N4 05 17S 8E SL	P	1902	S	0.000	0.000	C/O MILAS JOHNSON, BOX 336 PLEASANT DRIVE	RUTH LARUE JOHNSON	39.3794302642	-111.051561828
93-216	Point to Point	N660 E660 SW 05 17S 8E SL	P	1902	S	0.000	0.000	HUNTINGTON UT 84528	EDWARD HARRISON	39.3683539463	-111.056271892
93-225	Point to Point	S660 W660 N4 05 17S 8E SL	P	1902	S	0.000	0.000	C/O MILAS JOHNSON, BOX 336 PLEASANT DRIVE	RUTH LARUE JOHNSON	39.3794302642	-111.051561828
93-1136	Rediversion	N760 0 SW 05 17S 8E SL	P	1892	DIMOSP	0.000	2025.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461
93-1136	Rediversion	N100 E1270 SW 05 17S 8E SL	P	1892	DIMOSP	0.000	2025.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	-111.054112301
93-1137	Rediversion	N760 0 SW 05 17S 8E SL	P	1890	DIMOSP	0.000	3274.710	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461
93-1137	Rediversion	N100 E1270 SW 05 17S 8E SL	P	1890	DIMOSP	0.000	3274.710	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	-111.054112301
93-1138	Rediversion	N760 0 SW 05 17S 8E SL	P	1890	DIMOSP	0.000	50.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461

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93-1138	Rediversion	N100 E1270 SW 05 17S 8E SL	P	1890	DIMOSP	0.000	50.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	-111.054112301
93-1139	Rediversion	N760 0 SW 05 17S 8E SL	P	1890	DIMOSP	0.000	58.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.368627432	-111.058607461
93-1139	Rediversion	N100 E1270 SW 05 17S 8E SL	P	1890	DIMOSP	0.000	58.000	P.O. BOX 327	HUNTINGTON CLEVELAND IRRIGATION COMPANY	39.3668169133	-111.054112301
a14107	Rediversion	N760 0 SW 05 17S 8E SL	A	19800228	DIMSPX	0.000	3000.000	1594 WEST NORTH TEMPLE STE 310	STATE OF UTAH BOARD OF WATER RESOURCES	39.368627432	-111.058607461
a14107	Rediversion	N100 E1270 SW 05 17S 8E SL	A	19800228	DIMSPX	0.000	3000.000	1594 WEST NORTH TEMPLE STE 310	STATE OF UTAH BOARD OF WATER RESOURCES	39.3668169133	-111.054112301
93-152	Point to Point	S660 E660 N4 05 17S 8E SL	P	1902	S	0.000	0.000	675 EAST 500 SOUTH, SUITE 500	UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMIN.	39.3794322651	-111.046890515

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APPROPRIATED POINTS OF DIVERSION
SEC. 6, T. 17 S., R. 8 E.

(Data downloaded from the Utah Division of Water Rights Web site, 29 Jan 2015)

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Utah Division of Water Rights

Search of TOWNSHIP = '17S' and RANGE = '8E' and SECTION_NO = '06' and BEM = 'SL'

WR Number	Diversion Type	Well Log	Location	Status	Priority	Uses	CFS	ACFT	Address	Owner Name	Latitude	Longitude
93-954	Surface		N1565 W1430 SE 06 17S 8E SL	A	19220808	IS	75.000	0.000	UPPER COLORADO REGION	USA BUREAU OF RECLAMATION -- PROVO AREA OFFICE	39.3708356568	-111.063669273
a3812	Rediversion		S650 W50 NW 06 17S 8E SL	A	19601102	I	0.000	10000.000	P.O. BOX 327	HUNTINGTON-CLEVELAND IRRIGATION COMPANY	39.3794971344	-111.077732083
a3812	Rediversion		S1350 E1300 NW 06 17S 8E SL	A	19601102	I	0.000	10000.000	P.O. BOX 327	HUNTINGTON-CLEVELAND IRRIGATION COMPANY	39.3775776916	-111.072952553
93-214	Point to Point		N660 W660 SE 06 17S 8E SL	P	1902	S	0.000	0.000	ATTN: MS. JODY L. WILLIAMS	PACIFICORP DBA UTAH POWER & LIGHT COMPANY	39.3683515668	-111.060942579
93-1140	Surface		N1572 W1466 SE 06 17S 8E SL	A	19220808	I	0.000	4000.000	P O BOX 129	NORTH EMERY WATER USERS SPECIAL SERVICE DISTRICT	39.3708548696	-111.063796759
a15762	Rediversion		S370 E350 NW 06 17S 8E SL	A	19900730	IMP	0.000	31264.000	ATTN: CARLY BURTON	PACIFICORP DBA UTAH POWER & LIGHT COMPANY	39.3802670674	-111.076317339
E1708	Surface		S700 W1220 E4 06 17S 8E SL	A	19800915	IS	0.000	10.800	ATTN: CLAUDIA CONDER	PACIFICORP DBA UTAH POWER & LIGHT COMPANY	39.3719739677	-111.063078676

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APPROPRIATED POINTS OF DIVERSION
SEC. 31, T. 16 S., R. 8 E.

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APPROPRIATED POINTS OF DIVERSION
SEC. 32, T. 16 S., R. 8 E.

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Utah Division of Water Rights

Search of TOWNSHIP = '16S' and RANGE = '8E' and SECTION_NO = '32' and BEM = 'SL'

WR Number	Diversion Type	Well Log	Location	Status	Priority	Uses	CFS	ACFT	Address	Owner Name	Latitude	Longitude
93-564	Point to Point		S660 E660 NW 32 16S 8E SL	P	1902	S	0.000	0.000	675 EAST 500 SOUTH, 5TH FLOOR	UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMIN.	39.393872658	-111.055900439
93-564	Point to Point		N660 W660 S4 32 16S 8E SL	P	1902	S	0.000	0.000	675 EAST 500 SOUTH, 5TH FLOOR	UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMIN.	39.3830558845	-111.051146787

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APPENDIX 7-7

Operational Hydrology Design
Methods and Calculations

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Section III HYDROLOGICAL ANALYSIS

PURPOSE:

To evaluate the hydrological characteristics of the Deer Creek Mine waste rock storage facility and determine the design of ditches and culverts to properly handle the storm runoff, for both disturbed and undisturbed areas.

DESCRIPTION OF PROJECT:

The waste rock storage facility consists of 29.5 acres of distrubed land which are bordered by an earth berm and collection ditch. The berm retains the mine waste rock which is hauled in by truck and the ditch collects the undisturbed storm runoff which would normally flow through the storage site. The ditch conveys the water around the border of the site and discharges it into an existing man made channel in one case and into the natural drainage channel in another. (See drawing CM-10779 DR, Map Packet # 4-6) The access road is crossed in several cases by culverts which discharge into the natural drainage.

DESIGN PROCEDURE:

The waste rock storage facility was marked on a topographical map and separated into four drainage areas which would contribute runoff into the collection ditch at the perimeter of the site and a fifth area being the site itself. (See Exhibit A.) Peak runoff values were calculated by use of the "Storm Hydrograph Program" by Richard H. Hawkins and Kim A. Marshall, September 1979, Utah State University Foundation. (See Table 1 and Exhibits B thru F.)

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TABLE 1

STORM RUNOFF VALUES FOR 100 YEAR, 24 HOUR EVENT
RAINFALL DEPTH: 3.4 INCHES
DISTRIBUTION: SOIL CONSERVATION SERVICE TYPE II

DRAINAGE #	AREA SQ.M.	DRAINAGE LENGTH FT	SLOPE	VELOCITY FPS	T.O.C. HRS	PEAK FLOW/CFS	TIME TO PEAK/HR
1	.0214	1482	.22	4.7	.0876	8.58	11.99
2	.0867	3360	.49	7.1	.1315	34.59	11.99
3	.0361	2223	.58	7.8	0.792	13.06	12.06
4	.0619	2866	.48	7.0	.1137	24.72	11.99
5	.0459	1400	.005	0.7	.5556	12.50	12.05

CURVE NUMBER FOR #1 THRU #4 = 85 (See Exhibit I)

CURVE NUMBER OF #5 = 77

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UNDISTURBED DRAINAGE DITCH

The design of the collection ditch is based on Manning's equation for open channels. The design channel is a trapezoid shape with 1:3 side slopes and a varying bottom width. The value for Manning's N was calculated based on the size of the rocks in the channel lining. The riprap ditch lining design was based on the procedure in Applied Hydrology and Sedimentology for Disturbed Areas, by B.J. Barfield, R.C. Warner and C.T. Haan, Oklahoma Technical Press, 1981 (see Riprap Sizing Program, exhibit G). The ditch lining design requires a median rock diameter (D_{50}) of 3.5 inches in one case and up to 14 inches in another. As far as practical, the actual rock size will be graded to give a smooth distribution curve with the largest rock size (D_{100}) roughly equal to twice the D_{50} and the D_{20} equal to one half the D_{50}.

TABLE 2

UNDISTURBED DITCH AND CHANNEL LINING DESIGN VALUES

DITCH #	DRAINAGE AREAS CONTRIBUTING	PEAK FLOW CFS	CHANNEL SLOPE	BOTTOM WIDTH FT.	VELOCITY FPS	FLOW DEPTH FT.	D50 FT.	S.F. DITCH BOTTOM	S.F. BANKS
1	1	8.58	2%	2	3.56	0.618	.296	1.80	1.50
2	2	34.59	2%	3	4.72	1.14	.547	1.80	1.50
3	2 AND 3	47.65	2%	4	5.03	1.23	.590	1.80	1.50
4	2, 3, AND 4	72.37	4%	5	6.59	1.25	1.17	1.69	1.50

The area of the discharge from ditch 4 into the existing channel will be protected from erosion by a rock apron consisting of the same size and distribution of rocks as the channel lining used on the ditch itself. The apron will be fan shaped with the wide end 12 feet wide and will extend 15 feet from the end of the ditch.

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A filter layer will be placed beneath the rip-rap channel lining materials. The filter will consist of 2 inch minus road base material and will be placed in a layer equal in thickness to the D_{50} size of the ditch.

DISTURBED RUNOFF COLLECTION

The runoff which collects within the storage site will be confined within the perimeter berm and collected into one of two detention basins. This water will be retained and allowed to dissipate through evaporation. The total volume of the runoff to be collected was taken from the hydrograph analysis for Area 5, Exhibit F. The total runoff depth for the 100 year, 24 hour storm event was determined to be 1.357 inches over the 29.5 acre facility. Storage capacity of each basin is planned to allow for two 100 year storms plus sediment equal to 0.1 acre foot for each acre drained.

The operating plan for the storage site involves dividing the site into two sections and using only one section at a time. This limits the amount of area disturbed at any one time. Phase I will encompass the western end of the site to station 9+50. During Phase I, all runoff will be drained to the basin on the west end of the site. When the area of Phase I is filled, the soil in the berm will be used to cover the waste rock material and the area will be reclaimed. Runoff from the top of the reclaimed Phase I area will still run westward to the basin and runoff from the slopes will be conveyed in ditches to the basin until final approval to remove the basin. Thereafter drainage from Phase I areas will be directed into the existing drainage channels south of the site.

During Phase II of the operating plan, runoff will be collected in a detention basin located along the south berm at station 7+80. Runoff during Phase II will be handled as previously described for Phase I. Basin design values and volumes are listed in Table 3.

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TABLE 3

	AREA	100 YR STORM RUNOFF VOLUME	SEDIMENT VOLUME	TOTAL REQUIRED VOLUME
PHASE I	9.8 ACRES	1.1 AC FT	.98 AC FT	3.18 AC FT
PHASE II	19.4 ACRES	2.2 AC-FT	1.94 AC FT	6.34 AC FT

RUNOFF VOLUME = 1.357" X AREA

TOTAL REQUIRED VOLUME = 2 X 100 YEAR STORM RUNOFF + SEDIMENT VOLUME

Each of the detention basins will have an emergency spillway capable of discharging the runoff anticipated from a 100 year, 24 storm event. Because of the extra storage capacity built into the basins to ensure total containment, no principal spillway is provided. The emergency spillway will consist of an open channel with grouted bottom and sides to prevent erosion. The spillway crest will be at the top of the water elevation shown on the accompanying drawings. The spillway flow rate was determined using the Soil Conservation Service National Engineering Handbook Section 4, Hydrology, Chapter 21. (Exhibit H) The spillways are designed as broad crested weirs, with flow depths slightly above one foot. The channel design parameters are listed below:

	Peak Flow	Channel Width	Flow Depth
Basin 1	10.77cfs	3 ft	1.18 ft
Basin 2	19.76cfs	6 ft	1.11 ft

Each of the spillway channels will have a minimum 1.5 foot depth to ensure the channel capacity will not be exceeded. An energy dissipation section will be constructed on the end of each channel to prevent erosion of the receiving channel streambanks. Details of each spillway are shown on drawings of each respective basin.

Ditches used to collect the disturbed runoff are designed as vee shaped, one foot deep, with 1:3 side slopes. These ditches will generally convey the runoff from the side slopes of the waste pile to the detention basin. The ditch between Phase I and II areas will carry the most runoff and only the design of this ditch is given, the others obviously meeting the capacity requirements.

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The flow rate for the separation ditch is taken as a percentage of the peak flow for the entire site. The maximum area which could be drained by the separation ditch (the entire area of Phase II) is 19.4 acres. The peak flow is:

19.4 X 12.50 cfs / 29.4 acres = 8.25 cfs.

Revised 6-7-88
Revised 8-4-88

The depth of flow for a 2% channel slope is 0.61 feet, which leaves more than adequate freeboard. (See Exhibit J and Ditch Design Program, Exhibit G.)

ACCESS ROAD DRAINAGE

Culverts will be used to convey the anticipated storm runoff across the access road. The ditch on the east end of the storage site discharges into the natural channel which crosses the access road. An 18 inch diameter culvert will be installed with a rock head wall on the inlet end and discharge into the natural channel. Three additional culverts will be located along the access road between the storage site and the highway. The culverts will also be 18 inch diameter and will have a rock head wall and discharge into a natural channel or a rock apron if no natural channel exists. The culverts will be spaced not more than 600 feet apart along the road which has a 3.8% grade. The 18 inch culverts will handle a flow of 5.5 cfs without exceeding a headwater depth equal to the diameter of the pipe. The sizing of the culverts is based on Area 1 at the beginning of this section. The 100 year storm event, with total precipitation of 3.4 inches, yielded a design flow of 8.58 cfs. The 10 year storm event is the basis of the design of the culverts and has a total precipitation of 2.2 inches (NOAA ATLAS 2, Volume VI Utah, Figure 27). From the SCS NEH 4, Hydrology, Fig 10.1 the direct runoff from the 100 year event, P=3.4 inches and CN = 85, is 1.9 inches, and the runoff from the 10 year event, P=2.2 inches and CN=85, is 0.95 inches. Therefore the flow rate for the culvert can be estimated as 8.58 cfs x (0.95/1.9) = 4.29 cfs. This is well below the capacity at the 18 inch culvert.

Rock aprons used on the discharge end of the 18 inch diameter culverts are designed according to Applied Hydrology, page 538. Using the design flow of 4.29 cfs and a tailwater depth less than one half the diameter, the length of the apron is 8 feet and the D_{50} is three inches. The width of the apron is 9.5 feet.

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INTERIM DRAINAGE

Two rip-rap, final reclamation channels, Channel 1A and 1B (See Map Packet 4-5), will be constructed as the refuse elevation increases during Phase I. Calculations for the channels are found in Tables 4,5 and Map 4-4). Because of the commitment to fill the north part of Phase I before the south part, one channel will be constructed prior to the other. Berms will direct the surface flow into Channel 1A and 1B, as indicated on Map Packet 4-5. Runoff from the temporary refuse access will flow onto the south pad and then to the designed channel.

A small area of Phase I (East Outslope) is not treated by the Phase I Sediment Basin. This same area can be treated upon construction of the Phase II Sediment Basin. The refuse outslope of this area is treated by siltfence at the outslope toe. This is considered a BTCA until the Phase II Sediment Basin construction (See Map 4-5) is complete.

Flow from the east refuse outslope reports to a roadside ditch near station 24+00 and eventually to an 18" diameter road drainage culvert at station 23+20 (See Map 4-5). The drainage areas for the culvert and ditch are shown on Figures 1 and 2, respectively. The east refuse outslope is included within the ditch drainage area depicted in Figure 2. Calculations for a 10 year/6 hour storm event indicate a flow to the culvert of 8.16 cfs, which is only 58% of its capacity (See Exhibit VI). Drainage calculations for the area which reports to the roadside ditch (See Exhibit VII) result in a flow of 1.15 cfs. Only 0.03 cfs of the 1.15 cfs results from the east refuse outslope (See Exhibit VIII). The maximum capacity of the ditch is 25.26 cfs; therefore, 1.15 cfs results in a flow depth of only 0.31 feet, with approximately 0.7 feet of freeboard (See Exhibit IX). These calculations indicate that the design flows are easily contained by the culvert and ditch.

Phase II interim drainage will be directed to the Phase II Sediment Basin in a similar manner as Phase I. During the filling of the north part of Phase II, the refuse pad drainage will be directed to the south part of Phase 2 via a temporary channel 2A. The discharge from temporary channel 2A will then flow to the sediment basin. Final reclamation channels 2A and 2B will be constructed as the south part of Phase II is filled (See Tables 4,5 and Map 4-4). The temporary channel 2A will be filled in as refuse elevation increases. (See Map 4-6)

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FIGURE 1
CULVERT DRAINAGE
NEAR STATION 24+00

4-13.2
ADDED 8-31-95

Project Title = **CULVERT DRAINAGE NEAR STATION 24+00**

WATERSHED HYDROGRAPH

Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 85.0
Area = 43.5 acres
Hydraulic length = 2800.00 Feet
Elevation change = 810.0 feet.
Concentration time = 0.14 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 43.5 acres

-- Storm data
Total precipitation = 1.2 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 8.16 cfs
Discharge volume = 1.00 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.013	0.000
1.20	0.013	0.000	*	1.30	0.013	0.000
1.40	0.013	0.000	*	1.50	0.013	0.000
1.60	0.023	0.000	*	1.70	0.023	0.000
1.80	0.023	0.000	*	1.90	0.023	0.000
2.00	0.023	0.000	*	2.10	0.089	0.010
2.20	0.089	0.928	*	2.30	0.089	3.065
2.40	0.089	5.634	*	2.50	0.089	8.162
2.60	0.024	6.526	*	2.70	0.024	4.467
2.80	0.024	4.064	*	2.90	0.024	3.760
3.00	0.024	3.646	*	3.10	0.019	3.445
3.20	0.019	3.267	*	3.30	0.019	3.274
3.40	0.019	3.303	*	3.50	0.019	3.355
3.60	0.013	2.963	*	3.70	0.013	2.618
3.80	0.013	2.543	*	3.90	0.013	2.504
4.00	0.013	2.501	*	4.10	0.012	2.414
4.20	0.012	2.340	*	4.30	0.012	2.337
4.40	0.012	2.343	*	4.50	0.012	2.358
4.60	0.010	2.194	*	4.70	0.010	2.052
4.80	0.010	2.022	*	4.90	0.010	2.007
5.00	0.010	2.008	*	5.10	0.009	1.936
5.20	0.009	1.875	*	5.30	0.009	1.866
5.40	0.009	1.863	*	5.50	0.009	1.868
5.60	0.010	1.969	*	5.70	0.010	2.059
5.80	0.010	2.095	*	5.90	0.010	2.123
6.00	0.010	2.144	*	6.10	0.000	1.237

EXHIBIT V

4-13.3

ADDED 8-31-95

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time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
6.10	0.000	1.237				
6.20	0.000	0.451	*	6.30	0.000	0.223
6.40	0.000	0.073	*			

EXHIBIT V

4-13.4

ADDED 8-31-95

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: **CULVERT FLOW**

Comment: **NEAR STATION 24+00**

Solve For Actual Depth

Given Input Data:

Diameter.....	1.50 ft
Slope.....	0.0500 ft/ft
Manning's n.....	0.024
Discharge.....	8.16 cfs

Computed Results:

Depth.....	0.87 ft
Velocity.....	7.64 fps
Flow Area.....	1.07 sf
Critical Depth....	1.11 ft
Critical Slope....	0.0257 ft/ft
Percent Full.....	58.23 %
Full Capacity.....	12.72 cfs
QMAX @.94D.....	13.69 cfs
Froude Number.....	1.59 (flow is Supercritical)

Open Channel Flow Module, Version 3.21 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

EXHIBIT VI

4-13.5
ADDED 8-31-95

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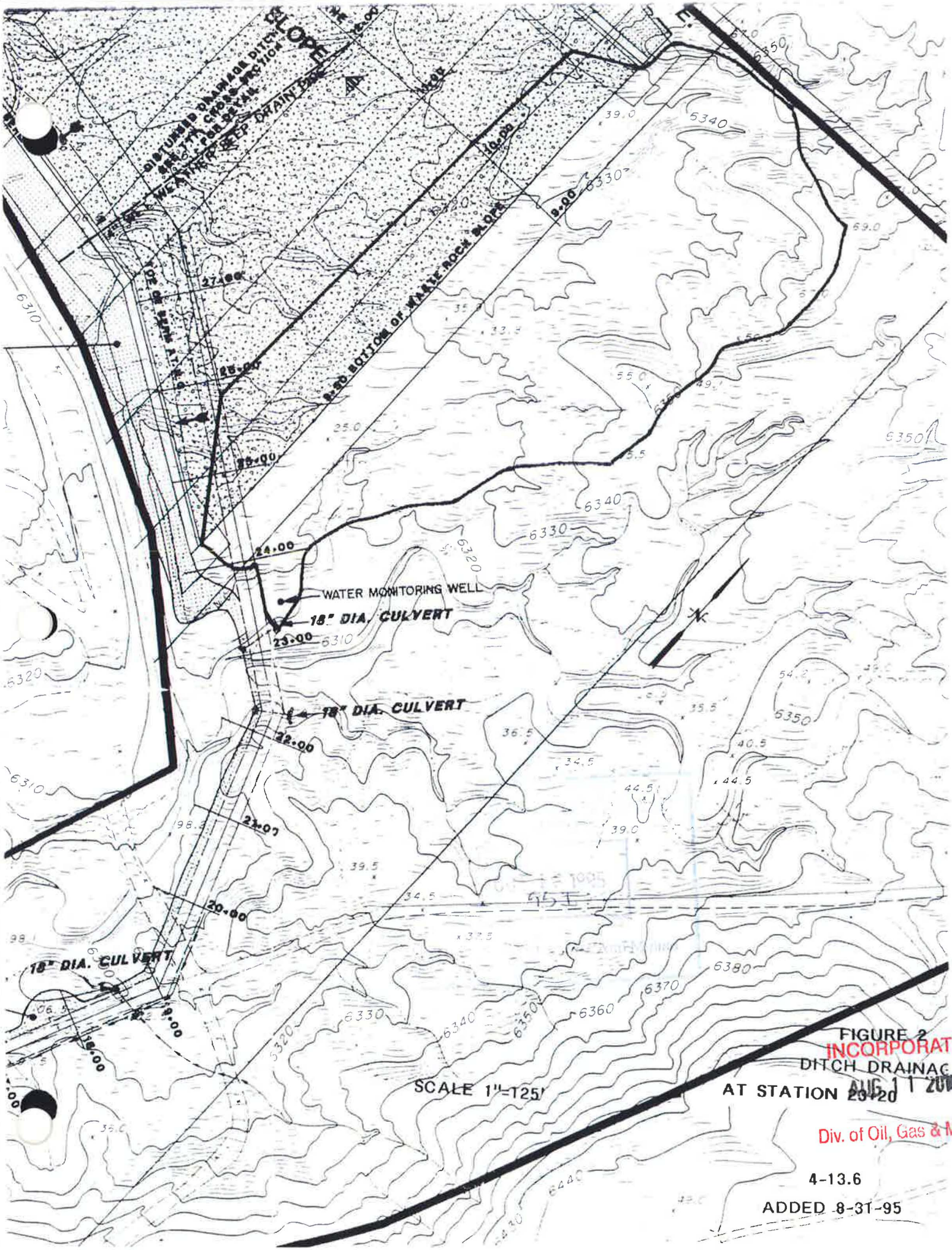

FIGURE 2
DITCH DRAINAGE
AT STATION 23+20

SCALE 1"=125'

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4-13.6
ADDED 8-31-95

Project Title = **DITCH DRAINAGE AT STA 23+20**
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 85.0
Area = 5.0 acres
Hydraulic length = 800.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.09 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 5.0 acres

-- Storm data
Total precipitation = 1.2 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 1.15 cfs
Discharge volume = 0.11 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.013	0.000
1.20	0.013	0.000	*	1.30	0.013	0.000
1.40	0.013	0.000	*	1.50	0.013	0.000
1.60	0.023	0.000	*	1.70	0.023	0.000
1.80	0.023	0.000	*	1.90	0.023	0.000
2.00	0.023	0.000	*	2.10	0.089	0.002
2.20	0.089	0.186	*	2.30	0.089	0.506
2.40	0.089	0.836	*	2.50	0.089	1.146
2.60	0.024	0.615	*	2.70	0.024	0.500
2.80	0.024	0.445	*	2.90	0.024	0.436
3.00	0.024	0.453	*	3.10	0.019	0.401
3.20	0.019	0.395	*	3.30	0.019	0.397
3.40	0.019	0.404	*	3.50	0.019	0.414
3.60	0.013	0.329	*	3.70	0.013	0.310
3.80	0.013	0.303	*	3.90	0.013	0.303
4.00	0.013	0.307	*	4.10	0.012	0.287
4.20	0.012	0.284	*	4.30	0.012	0.284
4.40	0.012	0.286	*	4.50	0.012	0.289
4.60	0.010	0.254	*	4.70	0.010	0.246
4.80	0.010	0.244	*	4.90	0.010	0.244
5.00	0.010	0.246	*	5.10	0.009	0.230
5.20	0.009	0.227	*	5.30	0.009	0.226
5.40	0.009	0.227	*	5.50	0.009	0.229
5.60	0.010	0.248	*	5.70	0.010	0.254
5.80	0.010	0.258	*	5.90	0.010	0.261
6.00	0.010	0.262	*	6.10	0.000	0.079

EXHIBIT VII

4-13.7
ADDED 8-31-95

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time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
6.10	0.000	0.079				
6.20	0.000	0.031	*	6.30	0.000	0.008
6.40	0.000	0.000	*			

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EXHIBIT VII

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Project Title = PHASE 1 REFUSE OUTSLOPE DRAINAGE
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 1.1 acres
Hydraulic length = 675.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.07 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 1.1 acres

-- Storm data
Total precipitation = 1.2 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.03 cfs
Discharge volume = 0.01 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.008	0.000
0.20	0.008	0.000	*	0.30	0.008	0.000
0.40	0.008	0.000	*	0.50	0.008	0.000
0.60	0.012	0.000	*	0.70	0.012	0.000
0.80	0.012	0.000	*	0.90	0.012	0.000
1.00	0.012	0.000	*	1.10	0.013	0.000
1.20	0.013	0.000	*	1.30	0.013	0.000
1.40	0.013	0.000	*	1.50	0.013	0.000
1.60	0.023	0.000	*	1.70	0.023	0.000
1.80	0.023	0.000	*	1.90	0.023	0.000
2.00	0.023	0.000	*	2.10	0.089	0.000
2.20	0.089	0.000	*	2.30	0.089	0.000
2.40	0.089	0.000	*	2.50	0.089	0.007
2.60	0.024	0.009	*	2.70	0.024	0.013
2.80	0.024	0.016	*	2.90	0.024	0.019
3.00	0.024	0.023	*	3.10	0.019	0.022
3.20	0.019	0.023	*	3.30	0.019	0.025
3.40	0.019	0.027	*	3.50	0.019	0.029
3.60	0.013	0.023	*	3.70	0.013	0.022
3.80	0.013	0.023	*	3.90	0.013	0.024
4.00	0.013	0.024	*	4.10	0.012	0.023
4.20	0.012	0.023	*	4.30	0.012	0.024
4.40	0.012	0.025	*	4.50	0.012	0.025
4.60	0.010	0.022	*	4.70	0.010	0.022
4.80	0.010	0.022	*	4.90	0.010	0.022
5.00	0.010	0.023	*	5.10	0.009	0.021
5.20	0.009	0.021	*	5.30	0.009	0.022
5.40	0.009	0.022	*	5.50	0.009	0.022
5.60	0.010	0.024	*	5.70	0.010	0.025
5.80	0.010	0.026	*	5.90	0.010	0.026
6.00	0.010	0.027	*	6.10	0.000	0.006

should be 100/6
.45 cfs
.04 acre feet runoff volume
based on 10 yr 6 hour event

EXHIBIT VIII

4-13.9
ADDED 8-31-95

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time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
6.10	0.000	0.006				
6.20	0.000	0.002	*			

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EXHIBIT VIII

4-13.10
ADDED 8-31-95

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: **DITCH FLOW**

Comment: **AT STA 23+20**

Solve For Depth

Given Input Data:

Left Side Slope..	3.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.024
Channel Slope....	0.0500 ft/ft
Discharge.....	1.15 cfs

Computed Results:

Depth.....	0.31 ft
Velocity.....	3.89 fps
Flow Area.....	0.30 sf
Flow Top Width...	1.88 ft
Wetted Perimeter.	1.99 ft
Critical Depth...	0.39 ft
Critical Slope...	0.0155 ft/ft
Froude Number....	1.73 (flow is Supercritical)

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Open Channel Flow Module, Version 3.21 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

OCT 19 1995
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EXHIBIT IX **4-13.11**

ADDED 8-31-95

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: **DITCH FLOW**

Comment: **AT STA 23+20**

Solve For Discharge

Given Input Data:

Left Side Slope..	3.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.024
Channel Slope....	0.0500 ft/ft
Depth.....	1.00 ft

Computed Results:

Discharge.....	25.26 cfs
Velocity.....	8.42 fps
Flow Area.....	3.00 sf
Flow Top Width...	6.00 ft
Wetted Perimeter.	6.32 ft
Critical Depth...	1.35 ft
Critical Slope...	0.0103 ft/ft
Froude Number....	2.10 (flow is Supercritical)

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Open Channel Flow Module, Version 3.21 (c) 1990
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TABLE 1

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #1

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0214 SQ. MILES (3.7 acres)
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 85
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .0876 HRS.

HYDROGRAPH ORDINATES:

TIME (HR)	PPT (IN)	CUM. FLOW (IN)	DEL. FLOW (IN)	FLOW RATE (IN/HR)	FLOW RATE (CFS)
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.01	0.00	0.0000	0.0000	0.0000	0.00
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.04	0.00	0.0000	0.0000	0.0000	0.00
0.05	0.00	0.0000	0.0000	0.0000	0.00
0.06	0.00	0.0000	0.0000	0.0000	0.00
0.07	0.00	0.0000	0.0000	0.0000	0.00
0.08	0.00	0.0000	0.0000	0.0000	0.00
0.09	0.00	0.0000	0.0000	0.0000	0.00
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.13	0.00	0.0000	0.0000	0.0000	0.00
0.14	0.00	0.0000	0.0000	0.0000	0.00
0.15	0.01	0.0000	0.0000	0.0000	0.00
0.16	0.01	0.0000	0.0000	0.0000	0.00
0.18	0.01	0.0000	0.0000	0.0000	0.00
0.19	0.01	0.0000	0.0000	0.0000	0.00
0.20	0.01	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.22	0.01	0.0000	0.0000	0.0000	0.00
0.23	0.01	0.0000	0.0000	0.0000	0.00
0.25	0.01	0.0000	0.0000	0.0000	0.00
0.26	0.01	0.0000	0.0000	0.0000	0.00
0.27	0.01	0.0000	0.0000	0.0000	0.00
0.28	0.01	0.0000	0.0000	0.0000	0.00
0.29	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.34	0.01	0.0000	0.0000	0.0000	0.00
0.35	0.01	0.0000	0.0000	0.0000	0.00
0.36	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.39	0.01	0.0000	0.0000	0.0000	0.00

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11.54	1.87	0.7002	0.0068	0.5730	7.91
11.55	1.88	0.7070	0.0068	0.5744	7.93
11.56	1.89	0.7137	0.0068	0.5759	7.95
11.57	1.90	0.7206	0.0068	0.5773	7.97
11.59	1.91	0.7274	0.0068	0.5787	7.99
11.60	1.92	0.7342	0.0069	0.5801	8.01
11.61	1.93	0.7411	0.0069	0.5815	8.03
11.62	1.94	0.7480	0.0069	0.5828	8.05
11.63	1.94	0.7549	0.0069	0.5842	8.07
11.64	1.95	0.7619	0.0069	0.5855	8.09
11.66	1.96	0.7687	0.0069	0.5868	8.10
11.67	1.97	0.7756	0.0069	0.5882	8.12
11.68	1.98	0.7826	0.0070	0.5895	8.14
11.69	1.99	0.7895	0.0070	0.5908	8.16
11.70	2.00	0.7965	0.0070	0.5921	8.18
11.71	2.01	0.8035	0.0070	0.5933	8.19
11.73	2.02	0.8105	0.0070	0.5946	8.21
11.74	2.03	0.8175	0.0070	0.5958	8.23
11.75	2.04	0.8245	0.0070	0.5971	8.25
11.76	2.05	0.8316	0.0071	0.5983	8.26
11.77	2.06	0.8387	0.0071	0.5995	8.28
11.79	2.07	0.8457	0.0071	0.6008	8.30
11.80	2.08	0.8528	0.0071	0.6020	8.31
11.81	2.09	0.8599	0.0071	0.6032	8.33
11.82	2.10	0.8670	0.0071	0.6043	8.35
11.83	2.11	0.8742	0.0071	0.6055	8.36
11.84	2.12	0.8813	0.0072	0.6067	8.38
11.86	2.13	0.8884	0.0072	0.6078	8.39
11.87	2.14	0.8956	0.0072	0.6090	8.41
11.88	2.14	0.9028	0.0072	0.6101	8.43
11.89	2.15	0.9100	0.0072	0.6112	8.44
11.90	2.16	0.9172	0.0072	0.6123	8.46
11.91	2.17	0.9244	0.0072	0.6134	8.47
11.93	2.18	0.9316	0.0072	0.6145	8.49
11.94	2.19	0.9389	0.0073	0.6156	8.50
11.95	2.20	0.9461	0.0073	0.6167	8.52
11.96	2.21	0.9534	0.0073	0.6178	8.53
11.97	2.22	0.9607	0.0073	0.6188	8.55
11.98	2.23	0.9679	0.0073	0.6199	8.56
12.00	2.24	0.9752	0.0044	0.6209	8.58
12.01	2.25	0.9797	0.0024	0.6145	8.49
12.02	2.25	0.9821	0.0024	0.5956	8.22
12.03	2.25	0.9845	0.0024	0.5640	7.79
12.04	2.26	0.9870	0.0024	0.5199	7.18
12.05	2.26	0.9894	0.0024	0.4631	6.40
12.07	2.26	0.9919	0.0024	0.4056	5.60
12.08	2.26	0.9943	0.0024	0.3554	4.91
12.09	2.27	0.9968	0.0024	0.3127	4.32
12.10	2.27	0.9992	0.0024	0.2774	3.83
12.11	2.27	1.0016	0.0024	0.2496	3.45
12.12	2.28	1.0041	0.0025	0.2292	3.16
12.14	2.28	1.0065	0.0025	0.2162	2.99
12.15	2.28	1.0090	0.0025	0.2108	2.91

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23.92	3.40	1.9272	0.0003	0.0295	0.41
23.93	3.40	1.9276	0.0005	0.0295	0.41
23.94	3.40	1.9279	0.0003	0.0295	0.41
23.96	3.40	1.9283	0.0003	0.0295	0.41
23.97	3.40	1.9286	0.0003	0.0295	0.41
23.98	3.40	1.9289	0.0003	0.0295	0.41
23.99	3.40	1.9293	0.0003	0.0295	0.41
24.00	3.40	1.9296	0.0000	0.0293	0.40
24.01	3.40	1.9296	0.0000	0.0282	0.39
24.02	3.40	1.9296	0.0000	0.0262	0.36
24.04	3.40	1.9296	0.0000	0.0234	0.32
24.05	3.40	1.9296	0.0000	0.0197	0.27
24.06	3.40	1.9296	0.0000	0.0154	0.21
24.07	3.40	1.9296	0.0000	0.0116	0.16
24.08	3.40	1.9296	0.0000	0.0084	0.12
24.10	3.40	1.9296	0.0000	0.0057	0.08
24.11	3.40	1.9296	0.0000	0.0035	0.05
24.12	3.40	1.9296	0.0000	0.0018	0.03
24.13	3.40	1.9296	0.0000	0.0007	0.01
24.14	3.40	1.9296	0.0000	0.0001	0.00
24.15	3.40	1.9296	0.0000	0.0000	0.00
24.17	3.40	1.9296	0.0000	0.0000	0.00
24.18	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 11.991 HOURS
INITIAL ABSTRACTION = .353 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 8.583999 CFS

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TABLE 2

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #2

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0867 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 85
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .1315 HRS.

HYDROGRAPH ORDINATES:

TIME (HR)	PPT (IN)	CUM. FLOW (IN)	DEL. FLOW (IN)	FLOW RATE (IN/HR)	FLOW RATE (CFS)
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.04	0.00	0.0000	0.0000	0.0000	0.00
0.05	0.00	0.0000	0.0000	0.0000	0.00
0.07	0.00	0.0000	0.0000	0.0000	0.00
0.09	0.00	0.0000	0.0000	0.0000	0.00
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.14	0.00	0.0000	0.0000	0.0000	0.00
0.16	0.01	0.0000	0.0000	0.0000	0.00
0.18	0.01	0.0000	0.0000	0.0000	0.00
0.19	0.01	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.23	0.01	0.0000	0.0000	0.0000	0.00
0.25	0.01	0.0000	0.0000	0.0000	0.00
0.26	0.01	0.0000	0.0000	0.0000	0.00
0.28	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.35	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.39	0.01	0.0000	0.0000	0.0000	0.00
0.40	0.01	0.0000	0.0000	0.0000	0.00
0.42	0.01	0.0000	0.0000	0.0000	0.00
0.44	0.01	0.0000	0.0000	0.0000	0.00
0.46	0.02	0.0000	0.0000	0.0000	0.00
0.47	0.02	0.0000	0.0000	0.0000	0.00
0.49	0.02	0.0000	0.0000	0.0000	0.00
0.51	0.02	0.0000	0.0000	0.0000	0.00
0.53	0.02	0.0000	0.0000	0.0000	0.00
0.54	0.02	0.0000	0.0000	0.0000	0.00
0.56	0.02	0.0000	0.0000	0.0000	0.00
0.58	0.02	0.0000	0.0000	0.0000	0.00

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11.75	2.04	0.8229	0.0106	0.5932	32.19
11.76	2.05	0.8335	0.0106	0.5951	33.30
11.78	2.07	0.8441	0.0106	0.5970	33.40
11.80	2.08	0.8548	0.0107	0.5988	33.51
11.82	2.10	0.8654	0.0107	0.6007	33.61
11.83	2.11	0.8761	0.0107	0.6025	33.71
11.85	2.12	0.8869	0.0108	0.6043	33.81
11.87	2.14	0.8976	0.0108	0.6060	33.91
11.89	2.15	0.9084	0.0108	0.6077	34.00
11.91	2.17	0.9192	0.0108	0.6095	34.10
11.92	2.18	0.9301	0.0109	0.6112	34.19
11.94	2.20	0.9409	0.0109	0.6129	34.29
11.96	2.21	0.9518	0.0109	0.6145	34.38
11.98	2.22	0.9627	0.0109	0.6161	34.47
11.99	2.24	0.9737	0.0067	0.6177	34.56
12.01	2.25	0.9804	0.0037	0.6119	34.24
12.03	2.25	0.9840	0.0037	0.5926	33.21
12.05	2.26	0.9877	0.0037	0.5626	31.48
12.06	2.26	0.9914	0.0037	0.5190	29.04
12.08	2.27	0.9950	0.0037	0.4627	25.89
12.10	2.27	0.9987	0.0037	0.4054	22.68
12.12	2.28	1.0024	0.0037	0.3555	19.89
12.13	2.28	1.0060	0.0037	0.3129	17.51
12.15	2.28	1.0097	0.0037	0.2777	15.54
12.17	2.29	1.0134	0.0037	0.2496	13.98
12.19	2.29	1.0171	0.0037	0.2285	12.84
12.20	2.30	1.0208	0.0037	0.2166	12.12
12.22	2.30	1.0245	0.0037	0.2112	11.82
12.24	2.31	1.0282	0.0037	0.2103	11.77
12.26	2.31	1.0319	0.0037	0.2105	11.78
12.27	2.32	1.0356	0.0037	0.2107	11.79
12.29	2.32	1.0393	0.0037	0.2108	11.80
12.31	2.33	1.0430	0.0037	0.2110	11.80
12.33	2.33	1.0467	0.0037	0.2111	11.81
12.34	2.34	1.0504	0.0037	0.2113	11.82
12.36	2.34	1.0541	0.0037	0.2115	11.83
12.38	2.35	1.0578	0.0037	0.2116	11.84
12.40	2.35	1.0616	0.0037	0.2118	11.85
12.41	2.36	1.0653	0.0037	0.2119	11.86
12.43	2.36	1.0690	0.0037	0.2121	11.87
12.45	2.37	1.0727	0.0037	0.2122	11.87
12.47	2.37	1.0765	0.0037	0.2124	11.88
12.48	2.38	1.0802	0.0037	0.2125	11.89
12.50	2.38	1.0839	0.0037	0.2127	11.90
12.52	2.39	1.0877	0.0037	0.2128	11.91
12.54	2.39	1.0914	0.0037	0.2130	11.92
12.55	2.39	1.0951	0.0037	0.2131	11.92
12.57	2.40	1.0989	0.0037	0.2133	11.93
12.59	2.40	1.1026	0.0038	0.2134	11.94
12.61	2.41	1.1064	0.0038	0.2136	11.95
12.62	2.41	1.1101	0.0038	0.2137	11.96
12.64	2.42	1.1139	0.0038	0.2139	11.97
12.66	2.42	1.1177	0.0038	0.2140	11.97

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23.83	3.39	1.9245	0.0005	0.0295	1.65
23.85	3.39	1.9250	0.0005	0.0295	1.65
23.86	3.40	1.9255	0.0005	0.0295	1.65
23.88	3.40	1.9260	0.0005	0.0295	1.65
23.90	3.40	1.9266	0.0005	0.0295	1.65
23.92	3.40	1.9271	0.0005	0.0295	1.65
23.93	3.40	1.9276	0.0005	0.0295	1.65
23.95	3.40	1.9281	0.0005	0.0295	1.65
23.97	3.40	1.9286	0.0005	0.0295	1.65
23.99	3.40	1.9291	0.0004	0.0295	1.65
24.00	3.40	1.9296	0.0000	0.0293	1.64
24.02	3.40	1.9296	0.0000	0.0282	1.59
24.04	3.40	1.9296	0.0000	0.0263	1.47
24.06	3.40	1.9296	0.0000	0.0235	1.31
24.07	3.40	1.9296	0.0000	0.0198	1.11
24.09	3.40	1.9296	0.0000	0.0155	0.87
24.11	3.40	1.9296	0.0000	0.0117	0.65
24.13	3.40	1.9296	0.0000	0.0084	0.47
24.14	3.40	1.9296	0.0000	0.0057	0.32
24.16	3.40	1.9296	0.0000	0.0035	0.20
24.18	3.40	1.9296	0.0000	0.0019	0.10
24.20	3.40	1.9296	0.0000	0.0007	0.04
24.21	3.40	1.9296	0.0000	0.0001	0.01
24.23	3.40	1.9296	0.0000	0.0000	0.00
24.25	3.40	1.9296	0.0000	0.0000	0.00
24.27	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 11.980 HOURS
INITIAL ABSTRACTION = .358 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 34.593 CFS

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TABLE 3

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #3

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0361 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 85
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .792 HRS.

HYDROGRAPH ORDINATES:

TIME (HR)	PPT (IN)	CUM. FLOW (IN)	DEL. FLOW (IN)	FLOW RATE (IN/HR)	FLOW RATE (CFS)
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.42	0.01	0.0000	0.0000	0.0000	0.00
0.53	0.02	0.0000	0.0000	0.0000	0.00
0.63	0.02	0.0000	0.0000	0.0000	0.00
0.74	0.03	0.0000	0.0000	0.0000	0.00
0.84	0.03	0.0000	0.0000	0.0000	0.00
0.95	0.03	0.0000	0.0000	0.0000	0.00
1.06	0.04	0.0000	0.0000	0.0000	0.00
1.16	0.04	0.0000	0.0000	0.0000	0.00
1.27	0.04	0.0000	0.0000	0.0000	0.00
1.37	0.05	0.0000	0.0000	0.0000	0.00
1.48	0.05	0.0000	0.0000	0.0000	0.00
1.58	0.05	0.0000	0.0000	0.0000	0.00
1.69	0.06	0.0000	0.0000	0.0000	0.00
1.80	0.06	0.0000	0.0000	0.0000	0.00
1.90	0.06	0.0000	0.0000	0.0000	0.00
2.01	0.07	0.0000	0.0000	0.0000	0.00
2.11	0.07	0.0000	0.0000	0.0000	0.00
2.22	0.08	0.0000	0.0000	0.0000	0.00
2.32	0.08	0.0000	0.0000	0.0000	0.00
2.43	0.09	0.0000	0.0000	0.0000	0.00
2.53	0.10	0.0000	0.0000	0.0000	0.00
2.64	0.10	0.0000	0.0000	0.0000	0.00
2.75	0.11	0.0000	0.0000	0.0000	0.00
2.85	0.11	0.0000	0.0000	0.0000	0.00
2.96	0.12	0.0000	0.0000	0.0000	0.00
3.06	0.12	0.0000	0.0000	0.0000	0.00
3.17	0.13	0.0000	0.0000	0.0000	0.00
3.27	0.13	0.0000	0.0000	0.0000	0.00
3.38	0.14	0.0000	0.0000	0.0000	0.00
3.48	0.14	0.0000	0.0000	0.0000	0.00

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9.19	0.52	0.0160	0.0019	0.0121	0.28
9.29	0.54	0.0179	0.0020	0.0131	0.31
9.40	0.55	0.0199	0.0021	0.0141	0.33
9.50	0.56	0.0220	0.0022	0.0151	0.35
9.61	0.57	0.0242	0.0023	0.0161	0.38
9.72	0.58	0.0265	0.0024	0.0171	0.40
9.82	0.59	0.0289	0.0025	0.0180	0.42
9.93	0.60	0.0314	0.0083	0.0189	0.44
10.03	0.64	0.0397	0.0249	0.0215	0.50
10.14	0.72	0.0645	0.0296	0.0303	0.71
10.24	0.81	0.0942	0.0339	0.0468	1.09
10.35	0.90	0.1280	0.0376	0.0720	1.68
10.45	0.98	0.1656	0.0410	0.1071	2.50
10.56	1.07	0.2066	0.0440	0.1504	3.50
10.67	1.16	0.2507	0.0468	0.1953	4.55
10.77	1.24	0.2974	0.0492	0.2402	5.60
10.88	1.33	0.3467	0.0515	0.2842	6.62
10.98	1.41	0.3982	0.0536	0.3260	7.59
11.09	1.50	0.4517	0.0554	0.3648	8.50
11.19	1.58	0.5072	0.0571	0.3997	9.31
11.30	1.67	0.5643	0.0587	0.4300	10.02
11.40	1.76	0.6230	0.0602	0.4557	10.62
11.51	1.84	0.6833	0.0615	0.4784	11.15
11.62	1.93	0.7447	0.0628	0.4990	11.63
11.72	2.02	0.8075	0.0639	0.5179	12.06
11.83	2.10	0.8714	0.0650	0.5349	12.46
11.93	2.19	0.9363	0.0499	0.5506	12.83
12.04	2.25	0.9862	0.0221	0.5605	13.06
12.14	2.28	1.0084	0.0222	0.5565	12.96
12.25	2.31	1.0306	0.0223	0.5385	12.55
12.36	2.34	1.0529	0.0224	0.5065	11.80
12.46	2.37	1.0753	0.0225	0.4604	10.72
12.57	2.40	1.0978	0.0226	0.4072	9.49
12.67	2.43	1.1204	0.0227	0.3602	8.39
12.78	2.46	1.1431	0.0228	0.3193	7.44
12.88	2.48	1.1659	0.0229	0.2850	6.64
12.99	2.51	1.1888	0.0230	0.2574	6.00
13.09	2.54	1.2118	0.0230	0.2367	5.51
13.20	2.57	1.2348	0.0231	0.2231	5.20
13.31	2.60	1.2579	0.0232	0.2168	5.05
13.41	2.63	1.2811	0.0233	0.2160	5.03
13.52	2.66	1.3044	0.0234	0.2169	5.05
13.62	2.69	1.3278	0.0234	0.2177	5.07
13.73	2.71	1.3512	0.0235	0.2185	5.09
13.83	2.74	1.3747	0.0236	0.2193	5.11
13.94	2.77	1.3983	0.0174	0.2200	5.13
14.04	2.79	1.4156	0.0089	0.2190	5.10
14.15	2.80	1.4245	0.0089	0.2137	4.98
14.26	2.81	1.4334	0.0089	0.2042	4.76
14.36	2.82	1.4423	0.0089	0.1904	4.44
14.47	2.84	1.4512	0.0089	0.1723	4.01
14.57	2.85	1.4601	0.0089	0.1528	3.56
14.68	2.86	1.4690	0.0089	0.1358	3.16

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23.34	3.39	1.9101	0.0031	0.0294	0.69
23.45	3.38	1.9132	0.0031	0.0294	0.69
23.50	3.39	1.9162	0.0031	0.0294	0.69
23.65	3.39	1.9194	0.0031	0.0294	0.69
23.76	3.39	1.9225	0.0031	0.0294	0.69
23.87	3.40	1.9256	0.0031	0.0294	0.69
23.97	3.40	1.9287	0.0008	0.0294	0.69
24.08	3.40	1.9296	0.0000	0.0288	0.67
24.18	3.40	1.9296	0.0000	0.0273	0.64
24.29	3.40	1.9296	0.0000	0.0249	0.58
24.39	3.40	1.9296	0.0000	0.0216	0.50
24.50	3.40	1.9296	0.0000	0.0174	0.41
24.60	3.40	1.9296	0.0000	0.0134	0.31
24.71	3.40	1.9296	0.0000	0.0099	0.23
24.82	3.40	1.9296	0.0000	0.0069	0.16
24.92	3.40	1.9296	0.0000	0.0045	0.11
25.03	3.40	1.9296	0.0000	0.0026	0.06
25.13	3.40	1.9296	0.0000	0.0012	0.03
25.24	3.40	1.9296	0.0000	0.0004	0.01
25.34	3.40	1.9296	0.0000	0.0000	0.00
25.45	3.40	1.9296	0.0000	0.0000	0.00
25.56	3.40	1.9296	0.0000	0.0000	0.00
25.66	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 12.061 HOURS
INITIAL ABSTRACTION = .353 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 13.065 CFS

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TABLE 4

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #4

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0619 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 95
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .1137 HRS.

HYDROGRAPH ORDINATES:

TIME (HR)	PPT (IN)	CUM. FLOW (IN)	DEL. FLOW (IN)	FLOW RATE (IN/HR)	FLOW RATE (CFS)
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.02	0.00	0.0000	0.0000	0.0000	0.00
0.03	0.00	0.0000	0.0000	0.0000	0.00
0.05	0.00	0.0000	0.0000	0.0000	0.00
0.06	0.00	0.0000	0.0000	0.0000	0.00
0.08	0.00	0.0000	0.0000	0.0000	0.00
0.09	0.00	0.0000	0.0000	0.0000	0.00
0.11	0.00	0.0000	0.0000	0.0000	0.00
0.12	0.00	0.0000	0.0000	0.0000	0.00
0.14	0.00	0.0000	0.0000	0.0000	0.00
0.15	0.01	0.0000	0.0000	0.0000	0.00
0.17	0.01	0.0000	0.0000	0.0000	0.00
0.18	0.01	0.0000	0.0000	0.0000	0.00
0.20	0.01	0.0000	0.0000	0.0000	0.00
0.21	0.01	0.0000	0.0000	0.0000	0.00
0.23	0.01	0.0000	0.0000	0.0000	0.00
0.24	0.01	0.0000	0.0000	0.0000	0.00
0.26	0.01	0.0000	0.0000	0.0000	0.00
0.27	0.01	0.0000	0.0000	0.0000	0.00
0.29	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.32	0.01	0.0000	0.0000	0.0000	0.00
0.33	0.01	0.0000	0.0000	0.0000	0.00
0.35	0.01	0.0000	0.0000	0.0000	0.00
0.36	0.01	0.0000	0.0000	0.0000	0.00
0.38	0.01	0.0000	0.0000	0.0000	0.00
0.39	0.01	0.0000	0.0000	0.0000	0.00
0.41	0.01	0.0000	0.0000	0.0000	0.00
0.42	0.01	0.0000	0.0000	0.0000	0.00
0.44	0.01	0.0000	0.0000	0.0000	0.00
0.45	0.02	0.0000	0.0000	0.0000	0.00
0.47	0.02	0.0000	0.0000	0.0000	0.00
0.49	0.02	0.0000	0.0000	0.0000	0.00
0.50	0.02	0.0000	0.0000	0.0000	0.00

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11.76	2.05	0.8331	0.0092	0.5965	23.88
11.78	2.06	0.8422	0.0092	0.5981	23.89
11.79	2.08	0.8514	0.0092	0.5997	23.95
11.81	2.09	0.8606	0.0092	0.6012	24.02
11.82	2.10	0.8699	0.0093	0.6028	24.08
11.84	2.11	0.8791	0.0093	0.6043	24.14
11.86	2.13	0.8884	0.0093	0.6059	24.20
11.87	2.14	0.8977	0.0093	0.6074	24.26
11.89	2.15	0.9070	0.0093	0.6089	24.32
11.90	2.16	0.9164	0.0094	0.6103	24.38
11.92	2.18	0.9257	0.0094	0.6118	24.44
11.93	2.19	0.9351	0.0094	0.6132	24.50
11.95	2.20	0.9445	0.0094	0.6146	24.55
11.96	2.21	0.9540	0.0094	0.6160	24.61
11.98	2.22	0.9634	0.0095	0.6174	24.66
11.99	2.24	0.9729	0.0067	0.6188	24.72
12.01	2.25	0.9796	0.0032	0.6147	24.55
12.02	2.25	0.9828	0.0032	0.5980	23.89
12.04	2.25	0.9859	0.0032	0.5687	22.72
12.05	2.26	0.9891	0.0032	0.5263	21.04
12.07	2.26	0.9923	0.0032	0.4722	18.86
12.08	2.27	0.9954	0.0032	0.4138	16.53
12.10	2.27	0.9986	0.0032	0.3626	14.49
12.11	2.27	1.0018	0.0032	0.3189	12.74
12.13	2.28	1.0050	0.0032	0.2825	11.28
12.14	2.28	1.0082	0.0032	0.2535	10.13
12.16	2.29	1.0113	0.0032	0.2320	9.27
12.17	2.29	1.0145	0.0032	0.2180	8.71
12.19	2.30	1.0177	0.0032	0.2114	8.44
12.20	2.30	1.0209	0.0032	0.2101	8.39
12.22	2.30	1.0241	0.0032	0.2103	8.40
12.23	2.31	1.0273	0.0032	0.2104	8.41
12.25	2.31	1.0305	0.0032	0.2106	8.41
12.26	2.32	1.0337	0.0032	0.2107	8.42
12.28	2.32	1.0369	0.0032	0.2108	8.42
12.29	2.32	1.0401	0.0032	0.2110	8.43
12.31	2.33	1.0433	0.0032	0.2111	8.43
12.32	2.33	1.0465	0.0032	0.2112	8.44
12.34	2.34	1.0497	0.0032	0.2114	8.44
12.36	2.34	1.0529	0.0032	0.2115	8.45
12.37	2.34	1.0561	0.0032	0.2116	8.45
12.39	2.35	1.0593	0.0032	0.2118	8.46
12.40	2.35	1.0626	0.0032	0.2119	8.47
12.42	2.36	1.0658	0.0032	0.2121	8.47
12.43	2.36	1.0690	0.0032	0.2122	8.48
12.45	2.37	1.0722	0.0032	0.2123	8.48
12.46	2.37	1.0754	0.0032	0.2124	8.49
12.48	2.37	1.0787	0.0032	0.2126	8.49
12.49	2.38	1.0819	0.0032	0.2127	8.50
12.51	2.38	1.0851	0.0032	0.2128	8.50
12.52	2.39	1.0884	0.0032	0.2130	8.51
12.54	2.39	1.0916	0.0032	0.2131	8.51
12.55	2.39	1.0948	0.0032	0.2132	8.52

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23.82	3.39	1.9241	0.0004	0.0295	1.18
23.83	3.39	1.9246	0.0004	0.0295	1.18
23.85	3.39	1.9250	0.0004	0.0295	1.18
23.86	3.40	1.9255	0.0004	0.0295	1.18
23.88	3.40	1.9259	0.0004	0.0295	1.18
23.89	3.40	1.9264	0.0004	0.0295	1.18
23.91	3.40	1.9268	0.0004	0.0295	1.18
23.92	3.40	1.9273	0.0004	0.0295	1.18
23.94	3.40	1.9277	0.0004	0.0295	1.18
23.95	3.40	1.9282	0.0004	0.0295	1.18
23.97	3.40	1.9286	0.0004	0.0295	1.18
23.98	3.40	1.9290	0.0004	0.0295	1.18
24.00	3.40	1.9295	0.0001	0.0295	1.18
24.01	3.40	1.9296	0.0000	0.0187	1.15
24.03	3.40	1.9296	0.0000	0.0271	1.08
24.04	3.40	1.9296	0.0000	0.0246	0.98
24.06	3.40	1.9296	0.0000	0.0211	0.84
24.07	3.40	1.9296	0.0000	0.0169	0.67
24.09	3.40	1.9296	0.0000	0.0129	0.52
24.10	3.40	1.9296	0.0000	0.0095	0.38
24.12	3.40	1.9296	0.0000	0.0064	0.26
24.13	3.40	1.9296	0.0000	0.0042	0.17
24.15	3.40	1.9296	0.0000	0.0024	0.09
24.16	3.40	1.9296	0.0000	0.0011	0.04
24.18	3.40	1.9296	0.0000	0.0003	0.01
24.19	3.40	1.9296	0.0000	0.0000	0.00
24.21	3.40	1.9296	0.0000	0.0000	0.00
24.23	3.40	1.9296	0.0000	0.0000	0.00
24.24	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.93 IN. TIME TO PEAK = 11.988 HOURS
INITIAL ABSTRACTION = .353 IN. RUNOFF VOLUME CHECK = 1.933 IN.
PEAK FLOW = 24.722 CFS

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TABLE 5

STORM RUNOFF DETERMINATION
FOR
DEER CREEK WASTE ROCK SITE #5

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .0459 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 77
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .5556 HRS.

HYDROGRAPH ORDINATES:

TIME (HR)	PPT (IN)	CUM. FLOW (IN)	DEL. FLOW (IN)	FLOW RATE (IN/HR)	FLOW RATE (CFS)
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.07	0.00	0.0000	0.0000	0.0000	0.00
0.15	0.01	0.0000	0.0000	0.0000	0.00
0.22	0.01	0.0000	0.0000	0.0000	0.00
0.30	0.01	0.0000	0.0000	0.0000	0.00
0.37	0.01	0.0000	0.0000	0.0000	0.00
0.44	0.02	0.0000	0.0000	0.0000	0.00
0.52	0.02	0.0000	0.0000	0.0000	0.00
0.59	0.02	0.0000	0.0000	0.0000	0.00
0.67	0.02	0.0000	0.0000	0.0000	0.00
0.74	0.03	0.0000	0.0000	0.0000	0.00
0.81	0.03	0.0000	0.0000	0.0000	0.00
0.89	0.03	0.0000	0.0000	0.0000	0.00
0.96	0.03	0.0000	0.0000	0.0000	0.00
1.04	0.04	0.0000	0.0000	0.0000	0.00
1.11	0.04	0.0000	0.0000	0.0000	0.00
1.19	0.04	0.0000	0.0000	0.0000	0.00
1.26	0.04	0.0000	0.0000	0.0000	0.00
1.33	0.05	0.0000	0.0000	0.0000	0.00
1.41	0.05	0.0000	0.0000	0.0000	0.00
1.48	0.05	0.0000	0.0000	0.0000	0.00
1.56	0.05	0.0000	0.0000	0.0000	0.00
1.63	0.06	0.0000	0.0000	0.0000	0.00
1.70	0.06	0.0000	0.0000	0.0000	0.00
1.78	0.06	0.0000	0.0000	0.0000	0.00
1.85	0.06	0.0000	0.0000	0.0000	0.00
1.93	0.07	0.0000	0.0000	0.0000	0.00
2.00	0.07	0.0000	0.0000	0.0000	0.00
2.07	0.07	0.0000	0.0000	0.0000	0.00
2.15	0.08	0.0000	0.0000	0.0000	0.00
2.22	0.08	0.0000	0.0000	0.0000	0.00
2.30	0.08	0.0000	0.0000	0.0000	0.00
2.37	0.09	0.0000	0.0000	0.0000	0.00
2.44	0.09	0.0000	0.0000	0.0000	0.00

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10.37	0.91	0.0305	0.0119	0.0286	0.85
10.45	0.93	0.0424	0.0137	0.0445	1.32
10.52	1.04	0.0561	0.0152	0.0635	1.88
10.59	1.10	0.0714	0.0168	0.0845	2.50
10.67	1.16	0.0882	0.0183	0.1071	3.17
10.74	1.22	0.1065	0.0197	0.1304	3.86
10.82	1.28	0.1262	0.0210	0.1540	4.56
10.89	1.34	0.1471	0.0223	0.1773	5.25
10.96	1.40	0.1694	0.0235	0.1996	5.91
11.04	1.46	0.1929	0.0246	0.2209	6.54
11.11	1.52	0.2175	0.0257	0.2411	7.14
11.19	1.58	0.2431	0.0267	0.2602	7.71
11.26	1.64	0.2699	0.0277	0.2785	8.25
11.33	1.70	0.2976	0.0287	0.2958	8.76
11.41	1.76	0.3263	0.0296	0.3123	9.25
11.48	1.82	0.3559	0.0305	0.3281	9.72
11.56	1.88	0.3864	0.0313	0.3431	10.16
11.63	1.94	0.4177	0.0321	0.3575	10.59
11.70	2.00	0.4499	0.0329	0.3712	10.99
11.78	2.06	0.4827	0.0336	0.3842	11.38
11.85	2.12	0.5163	0.0343	0.3968	11.75
11.93	2.18	0.5506	0.0347	0.4088	12.11
12.00	2.24	0.5853	0.0118	0.4201	12.44
12.08	2.26	0.5971	0.0119	0.4213	12.48
12.15	2.28	0.6090	0.0120	0.4122	12.21
12.22	2.30	0.6209	0.0120	0.3926	11.63
12.30	2.32	0.6330	0.0121	0.3622	10.73
12.37	2.35	0.6451	0.0122	0.3212	9.51
12.45	2.37	0.6572	0.0122	0.2845	8.43
12.52	2.39	0.6695	0.0123	0.2525	7.48
12.59	2.41	0.6818	0.0124	0.2252	6.67
12.67	2.43	0.6941	0.0124	0.2028	6.01
12.74	2.45	0.7066	0.0125	0.1856	5.50
12.82	2.47	0.7191	0.0126	0.1736	5.14
12.89	2.49	0.7316	0.0126	0.1671	4.95
12.96	2.51	0.7442	0.0127	0.1662	4.92
13.04	2.53	0.7569	0.0127	0.1671	4.95
13.11	2.55	0.7696	0.0128	0.1680	4.98
13.19	2.57	0.7825	0.0129	0.1688	5.00
13.26	2.59	0.7953	0.0129	0.1697	5.03
13.33	2.61	0.8082	0.0130	0.1705	5.05
13.41	2.63	0.8212	0.0130	0.1714	5.08
13.48	2.65	0.8342	0.0131	0.1722	5.10
13.56	2.67	0.8473	0.0131	0.1730	5.12
13.63	2.69	0.8605	0.0132	0.1738	5.15
13.70	2.71	0.8737	0.0133	0.1746	5.17
13.78	2.73	0.8869	0.0133	0.1754	5.20
13.85	2.75	0.9003	0.0134	0.1762	5.22
13.93	2.77	0.9136	0.0133	0.1770	5.24
14.00	2.79	0.9269	0.0050	0.1777	5.26
14.08	2.80	0.9319	0.0051	0.1749	5.18
14.15	2.80	0.9370	0.0051	0.1688	5.00
14.22	2.81	0.9421	0.0051	0.1592	4.71

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22.15	3.34	1.3107	0.0018	0.0248	0.72
22.22	3.34	1.3125	0.0018	0.0248	0.73
22.30	3.34	1.3144	0.0018	0.0248	0.73
22.37	3.34	1.3162	0.0018	0.0248	0.73
22.45	3.35	1.3180	0.0018	0.0248	0.73
22.52	3.35	1.3199	0.0018	0.0248	0.73
22.59	3.35	1.3217	0.0018	0.0248	0.73
22.67	3.35	1.3235	0.0018	0.0248	0.73
22.74	3.34	1.3254	0.0018	0.0248	0.74
22.82	3.36	1.3272	0.0018	0.0248	0.74
22.89	3.36	1.3291	0.0018	0.0248	0.74
22.96	3.36	1.3309	0.0018	0.0248	0.74
23.04	3.37	1.3327	0.0018	0.0249	0.74
23.11	3.37	1.3346	0.0018	0.0249	0.74
23.19	3.37	1.3364	0.0018	0.0249	0.74
23.26	3.37	1.3383	0.0018	0.0249	0.74
23.34	3.38	1.3401	0.0018	0.0249	0.74
23.41	3.38	1.3419	0.0018	0.0249	0.74
23.48	3.38	1.3438	0.0018	0.0249	0.74
23.56	3.38	1.3456	0.0018	0.0249	0.74
23.63	3.39	1.3475	0.0018	0.0249	0.74
23.71	3.39	1.3493	0.0018	0.0249	0.74
23.78	3.39	1.3512	0.0018	0.0249	0.74
23.85	3.40	1.3530	0.0018	0.0249	0.74
23.93	3.40	1.3549	0.0018	0.0249	0.74
24.00	3.40	1.3567	0.0000	0.0249	0.74
24.08	3.40	1.3567	0.0000	0.0242	0.72
24.15	3.40	1.3567	0.0000	0.0227	0.67
24.22	3.40	1.3567	0.0000	0.0204	0.60
24.30	3.40	1.3567	0.0000	0.0174	0.52
24.37	3.40	1.3567	0.0000	0.0137	0.41
24.45	3.40	1.3567	0.0000	0.0104	0.31
24.52	3.40	1.3567	0.0000	0.0076	0.22
24.59	3.40	1.3567	0.0000	0.0052	0.15
24.67	3.40	1.3567	0.0000	0.0033	0.10
24.74	3.40	1.3567	0.0000	0.0018	0.05
24.82	3.40	1.3567	0.0000	0.0007	0.02
24.89	3.40	1.3567	0.0000	0.0001	0.00
24.96	3.40	1.3567	0.0000	0.0000	0.00
25.04	3.40	1.3567	0.0000	0.0000	0.00
25.11	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 1.357 IN. TIME TO PEAK = 12.047 HOURS
INITIAL ABSTRACTION = .597 IN. RUNOFF VOLUME CHECK = 1.359 IN.
PEAK FLOW. = 12.503 CFS

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```
1 CLS : REM                    RIPRAP SIZING PROGRAM TAKEN FROM
2 KEY OFF: REM    "APPLIED HYDROLOGY AND SEDIMENTOLOGY FOR DISTURBED AREAS"
3 REM:                    BY BARFEILD, WARNER AND HAAN,  PAGE 185
50 DEF FNSIND(I)=SIN(I*3.14159/180)
60 DEF FNCOSD(I)=COS(I*3.14159/180)
70 DEF FNTAND(I)=TAN(I*3.14159/180)
80 DEF FNATND(I)=(180/3.14159)*ATN(I)
100 PRINT TAB(13)"R I P R A P  S I Z I N G  F O R"
110 PRINT TAB(11)"T R A P A Z O I D A L  D I T C H E S "
120 PRINT
130 PRINT TAB(13)"ENTER LISTED PARAMETERS"
140 PRINT TAB(13)"1. FLOW RATE (CFS)"
150 PRINT TAB(13)"2. CHANNEL SLOPE"
160 PRINT TAB(13)"3. BOTTOM WIDTH (FT)"
170 PRINT TAB(13)"4. SIDE SLOPE"
180 PRINT TAB(13)"5. PHI ANGLE"
190 PRINT TAB(13)"6. SPECIFIC GRAVITY OF RIPRAP"
195 PRINT
300 LOCATE 5,32:INPUT"",Q
310 LOCATE 6,30:INPUT"",S
320 LOCATE 7,34:INPUT"",B
330 LOCATE 8,27:INPUT"",SS
340 LOCATE 9,26:INPUT"",PHI
350 LOCATE 10,43:INPUT"",SG
360 LOCATE 12,13:INPUT"DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM  ",DSF
370 LOCATE 13,13:INPUT"DESIRED SAFETY FACTOR FOR CHANNEL BANKS  ",DSFB
400 SA=FNATND(S) :SSA=FNATND(SS)
480 D50=1: D=1
490 Q=INT(Q*1000+.5)/1000
500 N=((D50)^(1/6))*(.0395)
503 D50=INT(D50*10000+.5)/10000
505 Q1=1.49*(S^.5)/N
508 A=B*D+D*D/SS
510 Q2=Q1*A^(5/3)/(B+2*D*(1+1/(SS^2))^(.5))^(2/3)
512 Q3=INT(Q2*1000+.5)/1000
514 IF Q3=Q GOTO 520
516 D=(Q/Q2*D+D)/2
518 GOTO 505
520 T=62.4*D*S
525 VEL=Q/A
526 VEL=INT(VEL*1000+.5)/1000 :D=INT(D*1000+.5)/1000
530 NU=21*T/(62.4*(SG-1)*D50)
540 SF=FNCOSD(SA)*FNTAND(PHI)/(FNSIND(SA)+NU*FNTAND(PHI))
600 REM LAMBDA = CHANNEL SLOPE ANGLE SA
605 NU=.76*NU : REM ASSUME Tmax = .76*t AND NU(BANK)=.76*NU
610 BETA=FNATND(FNCOSD(SA)/(2*FNSIND(SSA)/(NU*FNTAND(PHI))+FNSIND(SA)))
620 NUP=NU*(1+FNSIND(SA+BETA))/2
630 SFB=FNCOSD(SSA)*FNTAND(PHI)/(NUP*FNTAND(PHI)+FNSIND(SSA)*FNCOSD(BETA))
700 SF=INT(SF*1000+.5)/1000
710 SFB=INT(SFB*1000+.5)/1000
720 LOCATE 16,10:PRINT"VELOCITY     DEPTH      D50     S.F. BTM     S.F. BANK"
730 LOCATE 17,11:PRINT VEL;"      ";D;"    ";D50;"    ";SF;"      ";SFB;"    "
740 IF SFB=0 GOTO 815
750 IF SFB=DSFB GOTO 800
760 D50=(DSFB/SFB*D50+D50)/2
765 K=K+1:IF K=100 THEN GOTO 860
770 GOTO 500
800 IF SF>=DSF GOTO 820
810 LOCATE 20,13:PRINT"ERRROR: SF BANK > SF BTM":END
815 LOCATE 20,13:PRINT"ERROR: SFB=0": END
820 LOCATE 20,13:PRINT"RUN COMPLETE"
850 END
860 PRINT"Exceeds allowable number of iterations (see line 765)":END
```

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Exhibit G
Page 1 of 3

R I P R A P S I Z I N G F O R
T R A P A Z O I D A L D I T C H E S

ENTER LISTED PARAMETERS -
1. FLOW RATE (CFS) 8.5
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 6
4. SIDE SLOPE .333
5. PHI ANGLE 40
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.5
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.5

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
3.565	.618	.2965	1.803	1.5

RUN COMPLETE

Ok

R I P R A P S I Z I N G F O R
T R A P A Z O I D A L D I T C H E S

ENTER LISTED PARAMETERS
1. FLOW RATE (CFS) 34.59
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 3
4. SIDE SLOPE .333
5. PHI ANGLE 40
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.5
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.5

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
4.725	1.14	.5467	1.803	1.5

RUN COMPLETE

Ok

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R I P R A P S I Z I N G F O R
T R A P A Z O I D A L D I T C H E S

ENTER LISTED PARAMETERS
1. FLOW RATE (CFS) 47.65
2. CHANNEL SLOPE .02
3. BOTTOM WIDTH (FT) 4
4. SIDE SLOPE .333
5. PHI ANGLE 40
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.5
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.5

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
5.033	1.23	.5901	1.803	1.5

RUN COMPLETE

Ok

R I P R A P S I Z I N G F O R
T R A P A Z O I D A L D I T C H E S

ENTER LISTED PARAMETERS
1. FLOW RATE (CFS) 72.37
2. CHANNEL SLOPE .04
3. BOTTOM WIDTH (FT) 5
4. SIDE SLOPE .333
5. PHI ANGLE 41
6. SPECIFIC GRAVITY OF RIPRAP 2.65

DESIRED SAFETY FACTOR FOR CHANNEL BOTTOM 1.5
DESIRED SAFETY FACTOR FOR CHANNEL BANKS 1.5

VELOCITY	DEPTH	D50	S.F. BTM	S.F. BANK
6.59	1.253	1.1701	1.69	1.5

RUN COMPLETE

Ok

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EMERGENCY SPILLWAY DESIGN - SEDIMENT PONDS 1 & 2

METHOD - See National Engineering Handbook, Section 4, Hydrology, Chapter 21, Design Hydrographs page 21.49

1. Design Storm Rainfall Amount

   P=3.4 inches for 100 year, 24 hour storm event. No adjustment of this amount is required for the area or the time of concentration.

2. Determine the Runoff Amount

   for CN = 77, P = 3.4 figure 10.1
   Q_2 = 1.4"

3. Determine Hydrograph Family

   From figure 21.3, Hydrograph Family = #5

4. Determine Duration of Excess Rainfall, T_o

   From figure 21.4, T_o = 2.0 hrs.

5. Compute Initial Tp Valve

   Pond #1, Length = 700', Velocity = 0.7 fps, Tc_1 = .278 hrs
   Pond #2, Length = 700', Velocity = 0.7 fps, T = .278 hrs
   700', Velocity = 1.4 fps, T = .139 hrs
   Tc_2 = .417 hrs

   Tp_1 = .7 (Tc_1) = 0.195 hrs
   Tp_2 = .7 (Tc_2) = 0.292 hrs

6. Compute T_o/Tp

   T_o/Tp_1 = 10.26 hrs
   T_o/Tp_2 = 6.85 hrs

7. Select T_o/Tp Ratio

   T_o/Tp_1 = 10 for Pond #1
   T_o/Tp_2 = 6 for Pond #2

8. Revise Tp

   Rev Tp_1 = 2.0/10.0 = .200
   Rev Tp_2 = 2.0/ 6.0 = .333

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9. Compute qp A_1 = 9.8 Acres = .015 sq. mi.
A_2 = 19.4 Acres = .030 sq. mi.

$$qp_1 = \frac{484*A}{Rev\ Tp_1} = 36.30 \text{ cfs}$$

$$qp_2 = \frac{484*A}{Rev\ Tp_2} = 43.60 \text{ cfs}$$

10. Compute Q qp

Qqp_1 = (1.4) (36.3) = 50.8 cfs
Qqp_2 = (1.4) (43.6) = 61.0 cfs

11. Construct Hydrograph & Determine Maximum Flow Rate

Pond #1 Max q = 10.77 cfs see table 1
Pond #2 Max q = 19.76 cfs see table 2

12. Design Spillway

Assume a broad crested weir

$$Q = CLh^{3/2}$$

Q = Flow in cfs
C = Coefficient, use C = 2.80
L = Length of Wier
h = Head in Feet

Pond #1 L = 3' Q = 10.77 cfs

$$h = \left(\frac{Q}{CL}\right)^{2/3} = \left(\frac{10.77}{(2.8)(3)}\right)^{2/3} = 1.18'$$

Pond #2 L = 6' Q = 19.76 cfs

$$h = \left(\frac{19.76}{(2.8)(6)}\right)^{2/3} = 1.11'$$

To provide the required freeboard, make the spillways 1.5 feet deep.

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POND 1, EMERGENCY SPILLWAY HYDROGRAPH

HYDROGRAPH FAMILY 5, $T_o/Tp = 10$

	t/Tp	time,hrs	qc/qp	Flow,cfs	Qt/Q	Volume Inches
1	0.0	0.0	0.0	0.0	0.0	0.0
2	.67	.134	.013	.660	.003	.004
3	1.34	.268	.061	3.094	.022	.031
4	2.01	.402	.091	4.623	.059	.083
5	2.68	.536	.102	5.182	.107	.150
6	3.35	.670	.107	5.436	.159	.223
7	4.02	.804	.110	5.588	.213	.298
8	4.69	.938	.111	5.639	.268	.375
9	5.36	1.072	.111	5.639	.323	.452
10	6.03	1.206	.112	5.690	.378	.529
11	6.70	1.340	.112	5.690	.434	.608
12	7.37	1.474	.112	5.690	.490	.686
13	8.04	1.608	.116	5.893	.546	.764
14	8.71	1.742	.160	8.128	.615	.861
15	9.38	1.876	.198	10.058	.704	.986
16	10.05	2.010	.212	10.770	.805	1.127
17	10.72	2.144	.168	8.534	.900	1.260
18	11.39	2.278	.074	3.759	.960	1.344
19	12.06	2.412	.027	1.372	.985	1.379
20	12.73	2.546	.010	.508	.994	1.392

time = (t/Tp)* Rev Tp = (t/Tp)* (.200)
flow = (qc/qp)* Qqp = (qc/qp)* (50.8)
volume = (Q_T/Q)* Q = (Q_T/Q)* (1.4)

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POND 2, EMERGENCY SPILLWAY HYDROGRAPH

HYDROGRAPH FAMILY 5, $T_o/Tp = 6.0$

	t/Tp	time,hrs	qc/qp	flow,cfs	Qt/Q	Volume Inches
1	0.0	0.0	0.0	0.0	0.0	0.0
2	.52	.173	.015	.915	.003	.004
3	1.04	.346	.070	4.270	.019	.027
4	1.56	.519	.130	7.930	.057	.080
5	2.08	.693	.159	9.699	.112	.157
6	2.60	.866	.172	10.492	.176	.246
7	3.12	1.039	.178	10.858	.242	.339
8	3.64	1.212	.182	11.102	.311	.435
9	4.16	1.385	.183	11.163	.381	.533
10	4.68	1.558	.184	11.224	.451	.631
11	5.20	1.732	.218	13.298	.527	.738
12	5.72	1.905	.285	17.385	.623	.877
13	6.24	2.078	.324	19.764	.740	1.036
14	6.76	2.251	.267	16.287	.852	1.193
15	7.28	2.424	.133	8.113	.929	1.301
16	7.80	2.597	.064	3.904	.966	1.352
17	8.32	2.771	.029	1.769	.984	1.378
18	8.84	7.994	.016	.976	.993	1.390
19	9.36	3.117	.007	.427	.997	1.396
20	9.33	3.290	.003	.183	.999	1.399

time = (t/Tp) * Rev Tp = (t/Tp) * (.333)
flow = (qc/qp) * Qqp = (qc/qp) * (61.0)
volume = (Qt/Q) * Q = (Q_T/Q) * (1.4)

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CURVE NUMBER DETERMINATION - AREAS 1 THRU 4

LAND USE - WESTERN RANGELAND
15 TO 20% GROUND COVER
JUNIPER - GRASS COMPLEX

SOIL GROUP C - SLOW INFILTRATION RATE
SOIL LAYER IMPEDES DOWNWARD
MOVEMENT OF WATER, SLOW
RATE OF WATER TRANSMISSION

FIGURE 9.6 AT GROUND COVER = 17%, CN ≈ 85

AREA 5 - SAME AS ABOVE WITH GROUND COVER = 40%
≈ CN 77

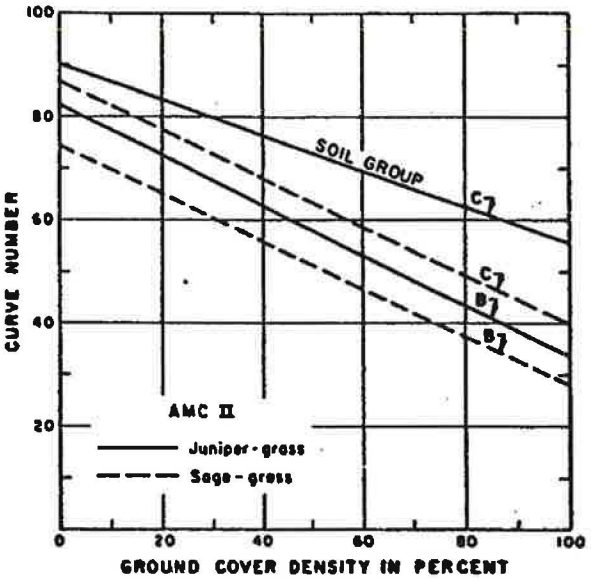

Figure 9.6.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: juniper-grass and sage-grass complexes.

SCS NATIONAL ENGINEERING HANDBOOK
SECTION 4, HYDROLOGY

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DEER CREEK MINE
WASTE ROCK SITE
ROAD ALIGNMENT
CHANNEL CHANGE

WATERSHED PARAMETERS (EXHIBIT A)

Distribution	SCS Type II
Design Storm Event	100-year, 24-hour
Rainfall Depth	3.4 inches
Area	0.2813 sq. miles
Curve Number	86
Watershed Length	4,448 feet
Watershed Slope	38.7%
Time of Concentration	0.2298 hrs.
Peak Flow (Table 1)	339 cfs

CHANNEL PARAMETERS (DRWG. DS1098A, SHEET 1 & 2)

Channel Slope	3.8%
Bottom Width	5 ft.
Side Slope	0.5 (2:1)
Manning's N	.025
Discharge	339 cfs
Flow Depth	2.34 ft.
Velocity	14.98 fps

Although the calculations indicate an erosive velocity, a field inspection by Division Hydrologist Tom Munson (3/6/89) verified the conclusion that the realigned channel is no more susceptible to erosional damage than is the natural channel. Therefore, it is proposed that no additional channel protection be installed.

The area will be inspected by UP&L personnel and Division Inspectors to insure the proposed measures are adequate.

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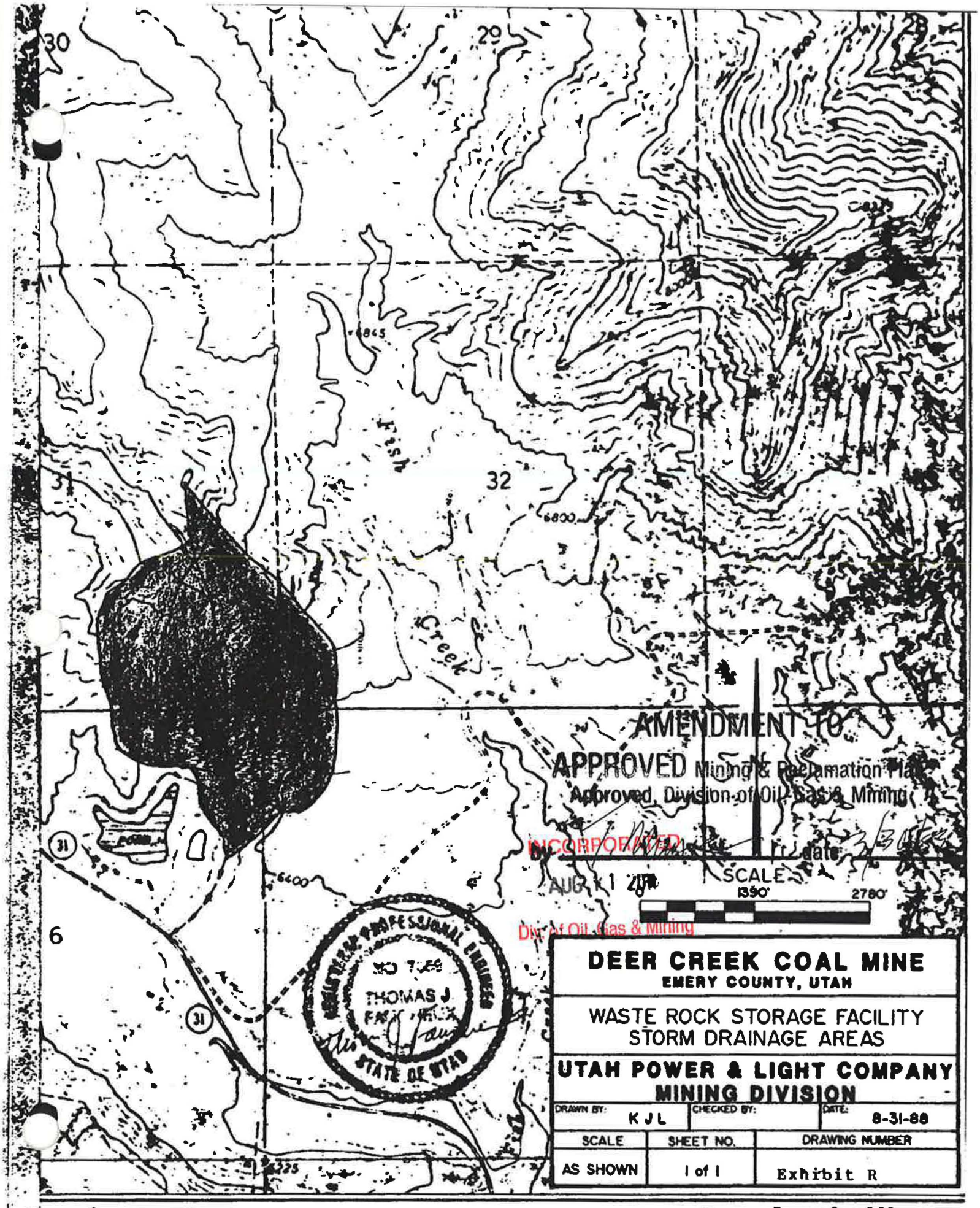
AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by T. Munson date 3/30/89



DEER CREEK COAL MINE
EMERY COUNTY, UTAH

WASTE ROCK STORAGE FACILITY
STORM DRAINAGE AREAS

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY:	CHECKED BY:	DATE:
K J L		8-31-88

SCALE	SHEET NO.	DRAWING NUMBER
AS SHOWN	1 of 1	Exhibit R

TABLE 1

STORM RUNOFF DETERMINATION
FOR
DEER CREEK

INPUT SUMMARY:

DISTRIBUTION = SCS TYPE II	RUNOFF AREA = .2813 SQ. MILES
RAINFALL DEPTH = 3.4 INCHES	RUNOFF CURVE NO. = 86
STORM DURATION = 24 HOURS	TIME OF CONCENTRATION = .2298 HRS.

HYDROGRAPH ORDINATES:

TIME (HR)	PPT (IN)	CUM. FLOW (IN)	DEL. FLOW (IN)	FLOW RATE (IN/HR)	FLOW RATE (CFS)
0.00	0.00	0.0000	0.0000	0.0000	0.00
0.03	0.00	0.0000	0.0000	0.0000	0.00
11.70	1.49	0.4851	0.0531	1.0103	183.40
11.74	1.57	0.5382	0.0545	1.1731	212.95
11.77	1.65	0.5927	0.0558	1.3197	239.58
11.80	1.73	0.6484	0.0570	1.4485	262.95
11.83	1.81	0.7054	0.0581	1.5576	282.76
11.86	1.89	0.7635	0.0591	1.6457	298.74
11.89	1.97	0.8226	0.0601	1.7113	310.65
11.92	2.04	0.8827	0.0610	1.7619	319.83
11.95	2.12	0.9437	0.0618	1.8063	327.90
11.98	2.20	1.0055	0.0445	1.8472	335.33
12.01	2.26	1.0500	0.0119	1.8674	338.98
12.04	2.27	1.0619	0.0119	1.8344	333.00
12.07	2.29	1.0739	0.0120	1.7479	317.29
12.10	2.30	1.0858	0.0120	1.6075	291.82
12.13	2.32	1.0978	0.0120	1.4130	256.50
12.16	2.33	1.1098	0.0120	1.1921	216.40
12.19	2.35	1.1218	0.0121	0.9969	180.96
24.33	3.40	2.0101	0.0000	0.0013	0.23
24.36	3.40	2.0101	0.0000	0.0004	0.07
24.39	3.40	2.0101	0.0000	0.0001	0.01
24.42	3.40	2.0101	0.0000	0.0000	0.00
24.45	3.40	2.0101	0.0000	0.0000	0.00
24.48	0.00	0.0000	0.0000	0.0000	0.00

OUTPUT SUMMARY:

TOTAL RUNOFF DEPTH = 2.01 IN.	TIME TO PEAK = 12.007 HOURS
INITIAL ABSTRACTION = .326 IN.	RUNOFF VOLUME CHECK = 2.014 IN.
PEAK FLOW = 339.042 CFS	

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Exhibit R
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APPENDIX 7-8

ASCA-1 Sediment Yield Calculations

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APPENDIX 7-8

EFFECTIVENESS OF SEDIMENT CONTROLS AT ASCA-1

Sediment yield from ASCA-1 at the Deer Creek Waste Rock Site was estimated utilizing the Revised Universal Soil Loss Equation ("RUSLE" - see Galetovic, 1998). The RUSLE is mathematically expressed as follows:

A=RKLSCP

Where:

A	=	Average annual soil loss in tons per acre per year
R	=	Rainfall/runoff erosivity
K	=	Soil erodibility
LS	=	Hillslope length and steepness
C	=	Cover management
P	=	Support practice

The **R factor** is an expression of the erosivity of rainfall and runoff at a particular location. The value of R increases as the amount and intensity of rainfall increases. The Deer Creek Waste Rock Site is not one of the monitoring locations found in the program's database. The town of Hiawatha, located approximately 10 miles north, is an area where climatic data has been recorded and is similar in elevation, temperature, orientation, etc., to the Deer Creek Waste Rock Site. Collected data has been input into the RUSLE database for estimation of the R-factor. The R-value for this area is estimated at 10.

The **K factor** is an expression of the inherent erodibility of the soil or surface material at the Deer Creek Waste Rock Site. The soil texture at this site is silty clay loam texture. The K-factor estimated for the areas of the Deer Creek Waste Rock Site is 0.24.

Topography was taken into account when calculating the **LS factor**. This factor takes the hillslope length (L) and gradient (S) as contributing to erosion. If either one of these factors increase, total soil loss per unit area will also increase. The slopes along the berm outslope have been constructed on a 2:1 gradient and are approximately 35 feet measured horizontally across a plane. The calculated LS factor is 2.55.

The **cover factor (C)** was determined for the soil by estimating average percent cover, effective root mass, etc. These estimations were made by visual examination of the site. Values were given to the various components used for estimating the cover factor. A factor of 0.0351 was calculated for this soil loss parameter.

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The **P factor** is an expression of the effects of supporting conservation practices, such as contouring, buffer strips of close-growing vegetation, and terracing, on soil loss at a particular site. The value of P decreases with the installation of these practices because they reduce runoff volume and velocity and encourage the deposition of sediment on the hillslope surface. Wattles

are used as the support practice at the Deer Creek Waste Rock Site and can effectively reduce the length slope, slow and spread surface flow of runoff allowing infiltration, resulting in a P factor equivalent to 0.18 with the use of wattles.

Table 1 below shows the results of the sediment control practices utilized at the Deer Creek Waste Rock Site. As indicated, the use of wattles provides over five times the protection as compared to using no sediment control practices.

TABLE 1

Results of RUSLE Calculation for ASCA-1

AREA	R	K	LS	C	P	A
ASCA-1 without wattles	10	0.24	2.55	0.0351	1	0.22
ASCA-1 with wattles	10	0.24	2.55	0.0351	0.18	0.04

Reference Cited

Galetovic, J.R. 1998. Guidelines for the Use of the Revised Universal Soil Loss Equation (RUSLE), Version 1.06, on Mined Lands, Construction Sites and Reclaimed Lands. Office of Technical Transfer, Western Regional Coordination Center, U.S. Office of Surface Mining. Denver, Colorado.

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APPENDIX 7-9

Reclamation Hydrology Design
Methods and Calculations

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DEER CREEK WASTE ROCK SITE
RECLAMATION HYDROLOGY CALCULATIONS

1.0 METHODS

The boundaries of watersheds draining across the reclaimed site were determined using the Hiawatha and Red Point USGS 7.5-minute quadrangles (see the accompanying map). Data obtained from these watersheds were input to HydroCAD, version 10.00 (developed by HydroCAD Software Solutions) to generate runoff hydrographs for the reclamation drainage channels. HydroCAD models runoff using the curve-number and triangular unit hydrograph methodologies of the U.S. Natural Resources Conservation Service (1997).

The design runoff calculations were performed using the 10-year, 24-hour and 100-year, 24-hour rainfall events. The Type II rainfall distribution was used to generate the hydrographs for these events. Consistent with the calculations performed by others for the design of the operational drainage system at the Deer Creek site, the following rainfall depths were used for this analysis:

10-yr, 24-hr: 2.2 inches
100-yr, 24-hr: 3.4 inches

A curve number of 85 was used for all runoff analyses, consistent with the value used in the calculation of runoff from undisturbed areas during the operational period. Given the planned use of deep gouging as a surface treatment during reclamation, this curve number is probably high for areas that will be reclaimed. Therefore, the modeled runoff is conservatively high.

HydroCAD allows the use of several methods for calculation of the time of concentration (a value used in generating the runoff hydrograph). For this analysis, the lag method was used, based on the following equations (U.S. Natural Resources Conservation Service, 1997):

$$L = \frac{l^{0.8}(S+1)^{0.7}}{1900Y^{0.5}} \quad (1)$$

and

$$T_c = 1.67L \quad (2)$$

where

L = watershed lag (hours)
l = hydraulic length of the watershed, or distance along the main channel to the watershed divide (feet)
S = (1000/CN)-10 (where CN = curve number)
Y = average watershed slope (percent)
T_c = time of concentration (hours)

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Drainage channels were designed to convey runoff across reclaimed areas in a non-erosive manner. Channel capacity and flow velocity were calculated within HydroCAD using the

Manning equation. A value of 0.040 was selected for Manning's roughness coefficient. Each channel was designed with a triangular or trapezoidal shape, 2H:1V side slopes, and a riprapped depth of 2 feet. Riprap was sized based on methods developed by the U.S. Soil Conservation Service (1977) to protect the channels from the maximum velocity experienced during the 100-year, 24-hr precipitation event.

2.0 RESULTS

The output from HydroCAD is attached and the results of those calculations are summarized in Tables 1 and 2 below.

TABLE 1

Peak Flow Estimates

Watershed[a]	Peak Flow (cfs)	
	10-yr, 24-hr	100-yr, 24-hr
RWS-1	88.57	178.81
RWS-2	8.77	17.67
RWS-3	17.15	34.47
RWS-4	110.42	225.01
RWS-5	6.08	12.47
RWS-6	17.77	35.59
RWS-7	4.51	9.01
RWS-8	7.46	14.88

[a] See attached figure

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TABLE 2

Reclamation Channel Design Summary

Reclamation Channel	Contributing Watershed	Bottom Width (ft)	Maximum Velocity (ft/s)		Riprap D_{50} (in)
			10-yr, 24-hr	100-yr, 24-hr	
RC-1	RWS-1	8	7.03	8.71	12
RC-2	RWS-2	0	4.66	5.56	4
RC-3	RWS-2	0	4.66	5.56	4
RC-4	RWS-3	2	5.46	6.59	6
RC-5	RWS-1, RWS-2, RWS-3. RWS-5	4	6.01	7.37	9
RC-6	RWS-5	0	4.94	5.91	4
RC7	RWS-4	10	7.32	9.13	12
RC-8	RWS-6	2	6.52	7.86	9
RC-9	RWS-6	2	6.52	7.86	9
RC-10	RWS-7	0	6.05	7.20	9
RC-11	RWS-8	0	6.76	8.04	12

Riprap sizing was determined using the tractive force method presented in Hydraulic Engineering Circular No.11 of the Federal Highway Administration (Brown and Clyde, 1989). These calculations are attached, following the HydroCAD printouts. The riprap will be placed at a thickness approximately equal to twice the D_{50} size. Consistent with experience gained at the operational channels, a filter layer (consisting of 2-inch minus road-base gravel) will be placed between the riprap and the underlying native soil.

3.0 REFERENCES

Brown, S.A. and E.S. Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. U.S. Department of Transportation, Federal Highway Administration. McLean, Virginia.

U.S. Natural Resources Conservation Service. 1997. National Engineering Handbook, Part 630 Hydrology. U.S. Department of Agriculture. Washington, D.C.

U.S. Soil Conservation Service. 1977. Design of Open Channels. Technical Release No. 25. U.S. Department of Agriculture. Washington, D.C.

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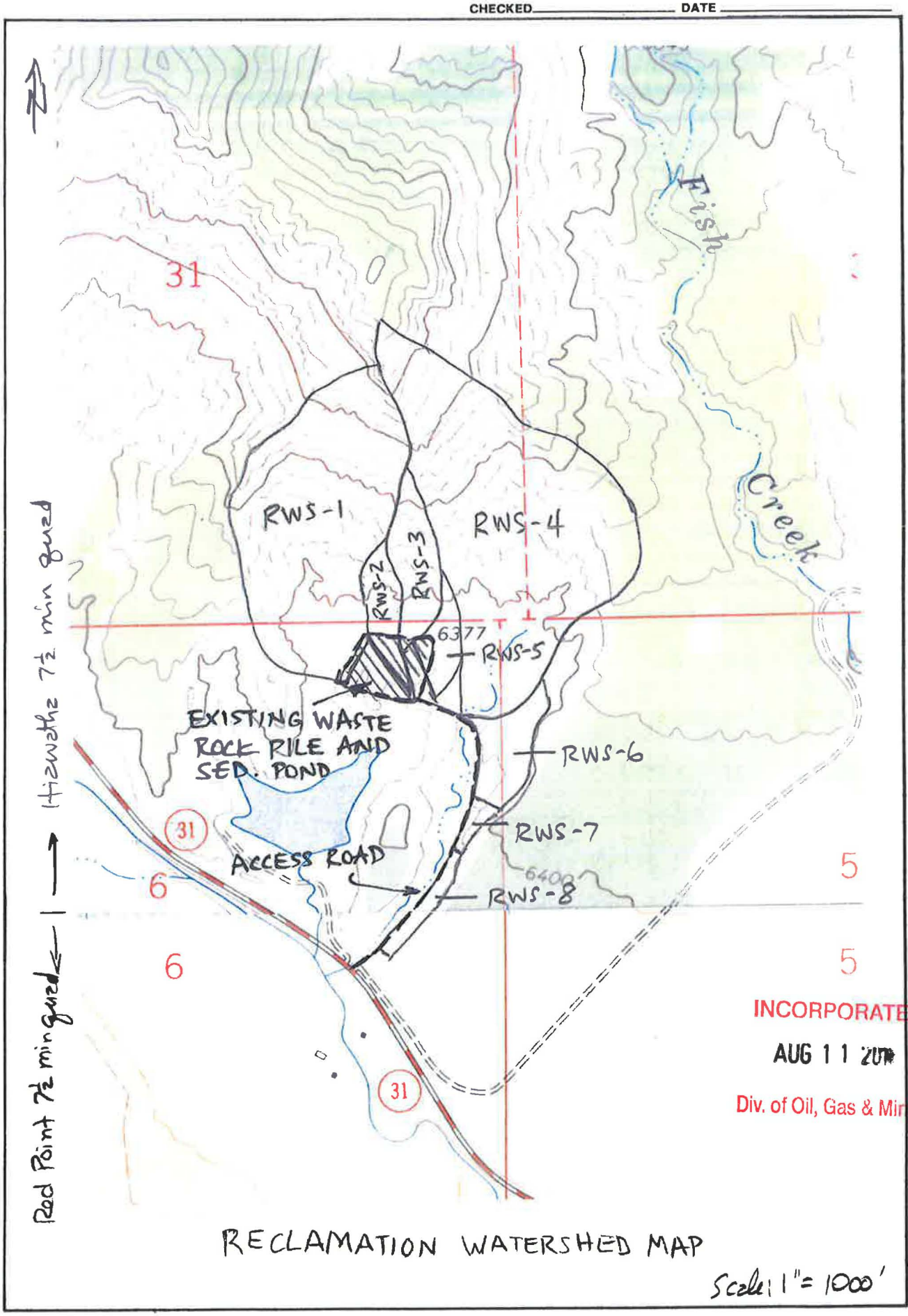

RECLAMATION WATERSHED MAP

Scale: 1" = 1000'

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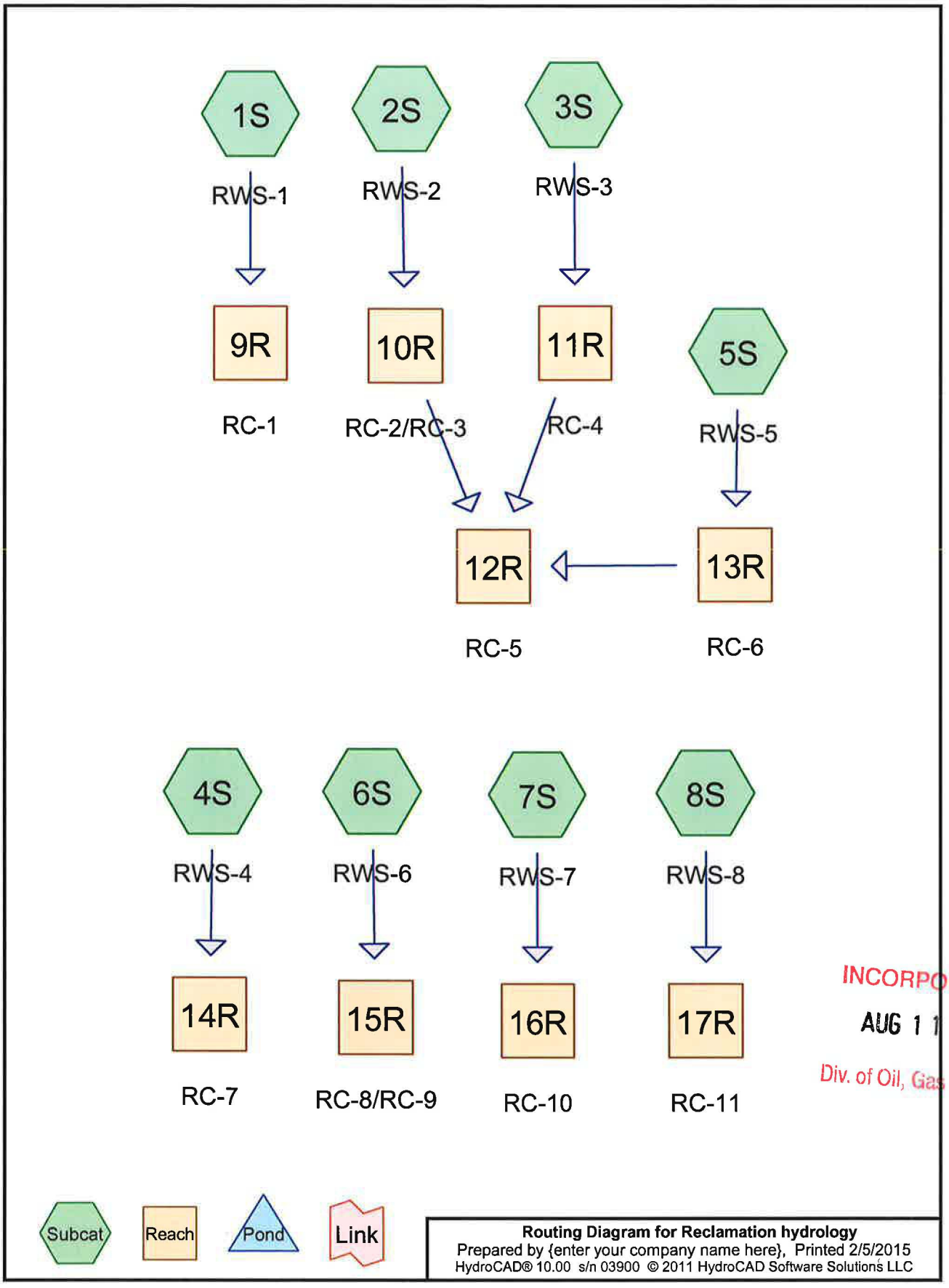

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: RWS-1 Runoff Area=53.500 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=2,800' Slope=0.8580 '/' Tc=6.6 min CN=85 Runoff=88.57 cfs 4.211 af

Subcatchment2S: RWS-2 Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=1,200' Slope=0.3060 '/' Tc=5.6 min CN=85 Runoff=8.77 cfs 0.401 af

Subcatchment3S: RWS-3 Runoff Area=9.600 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=1,300' Slope=0.5170 '/' Tc=4.6 min CN=85 Runoff=17.15 cfs 0.756 af

Subcatchment4S: RWS-4 Runoff Area=77.600 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=4,000' Slope=0.5920 '/' Tc=10.6 min CN=85 Runoff=110.42 cfs 6.108 af

Subcatchment5S: RWS-5 Runoff Area=4.800 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=1,000' Slope=0.0380 '/' Tc=13.8 min CN=85 Runoff=6.08 cfs 0.378 af

Subcatchment6S: RWS-6 Runoff Area=9.400 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=400' Slope=0.1760 '/' Tc=3.1 min CN=85 Runoff=17.77 cfs 0.740 af

Subcatchment7S: RWS-7 Runoff Area=2.300 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=200' Slope=0.1290 '/' Tc=2.1 min CN=85 Runoff=4.51 cfs 0.181 af

Subcatchment8S: RWS-8 Runoff Area=3.700 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=100' Slope=0.1070 '/' Tc=1.3 min CN=85 Runoff=7.46 cfs 0.291 af

Reach 9R: RC-1 Avg. Flow Depth=1.19' Max Vel=7.03 fps Inflow=88.57 cfs 4.211 af
n=0.040 L=580.0' S=0.0397 '/' Capacity=223.93 cfs Outflow=86.69 cfs 4.211 af

Reach 10R: RC-2/RC-3 Avg. Flow Depth=0.96' Max Vel=4.66 fps Inflow=8.77 cfs 0.401 af
n=0.040 L=370.0' S=0.0486 '/' Capacity=60.85 cfs Outflow=8.55 cfs 0.401 af

Reach 11R: RC-4 Avg. Flow Depth=0.83' Max Vel=5.46 fps Inflow=17.15 cfs 0.756 af
n=0.040 L=440.0' S=0.0500 '/' Capacity=106.00 cfs Outflow=16.67 cfs 0.756 af

Reach 12R: RC-5 Avg. Flow Depth=0.86' Max Vel=6.01 fps Inflow=30.00 cfs 1.535 af
n=0.040 L=410.0' S=0.0488 '/' Capacity=151.20 cfs Outflow=29.55 cfs 1.535 af

Reach 13R: RC-6 Avg. Flow Depth=0.78' Max Vel=4.94 fps Inflow=6.08 cfs 0.378 af
n=0.040 L=140.0' S=0.0714 '/' Capacity=73.74 cfs Outflow=6.07 cfs 0.378 af

Reach 14R: RC-7 Avg. Flow Depth=1.21' Max Vel=7.32 fps Inflow=110.42 cfs 6.108 af
n=0.040 L=50.0' S=0.0400 '/' Capacity=269.94 cfs Outflow=110.32 cfs 6.108 af

Reach 15R: RC-8/RC-9 Avg. Flow Depth=0.77' Max Vel=6.52 fps Inflow=17.77 cfs 0.740 af
n=0.040 L=90.0' S=0.0778 '/' Capacity=132.20 cfs Outflow=17.68 cfs 0.740 af

Reach 16R: RC-10 Avg. Flow Depth=0.61' Max Vel=6.05 fps Inflow=4.51 cfs 0.181 af
n=0.040 L=80.0' S=0.1500 '/' Capacity=106.85 cfs Outflow=4.48 cfs 0.181 af

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Reach 17R: RC-11 Avg. Flow Depth=0.74' Max Vel=6.76 fps Inflow=7.46 cfs 0.291 af
n=0.040 L=90.0' S=0.1444 '/' Capacity=104.86 cfs Outflow=7.38 cfs 0.291 af

Total Runoff Area = 166.000 ac Runoff Volume = 13.067 af Average Runoff Depth = 0.94"
100.00% Pervious = 166.000 ac 0.00% Impervious = 0.000 ac

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Summary for Subcatchment 1S: RWS-1

Runoff = 88.57 cfs @ 11.98 hrs, Volume= 4.211 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	53.500	85	
	53.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	2,800	0.8580	7.04		**Lag/CN Method, RWS-1**

Summary for Subcatchment 2S: RWS-2

Runoff = 8.77 cfs @ 11.97 hrs, Volume= 0.401 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	5.100	85	
	5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	1,200	0.3060	3.55		**Lag/CN Method, RWS-2**

Summary for Subcatchment 3S: RWS-3

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Runoff = 17.15 cfs @ 11.96 hrs, Volume= 0.756 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	9.600	85	
	9.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	1,300	0.5170	4.69		**Lag/CN Method, RWS-3**

Summary for Subcatchment 4S: RWS-4

Runoff = 110.42 cfs @ 12.03 hrs, Volume= 6.108 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	77.600	85	
	77.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	4,000	0.5920	6.28		**Lag/CN Method, RWS-4**

Summary for Subcatchment 5S: RWS-5

Runoff = 6.08 cfs @ 12.06 hrs, Volume= 0.378 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	4.800	85	
	4.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	1,000	0.0380	1.21		**Lag/CN Method, RWS-5**

Summary for Subcatchment 6S: RWS-6

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Runoff = 17.77 cfs @ 11.94 hrs, Volume= 0.740 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	9.400	85	
	9.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	400	0.1760	2.16		**Lag/CN Method, RWS-6**

Summary for Subcatchment 7S: RWS-7

Runoff = 4.51 cfs @ 11.93 hrs, Volume= 0.181 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	2.300	85	
	2.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	200	0.1290	1.61		**Lag/CN Method, RWS-7**

Summary for Subcatchment 8S: RWS-8

Runoff = 7.46 cfs @ 11.92 hrs, Volume= 0.291 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=2.20"

	Area (ac)	CN	Description
*	3.700	85	
	3.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.1070	1.28		**Lag/CN Method, RWS-8**

Summary for Reach 9R: RC-1

Inflow Area = 53.500 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 88.57 cfs @ 11.98 hrs, Volume= 4.211 af
Outflow = 86.69 cfs @ 12.02 hrs, Volume= 4.211 af, Atten= 2%, Lag= 2.3 min

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Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.03 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 5.8 min

Peak Storage= 7,161 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.19'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 223.93 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 580.0' Slope= 0.0397 '/'
Inlet Invert= 6,334.00', Outlet Invert= 6,311.00'

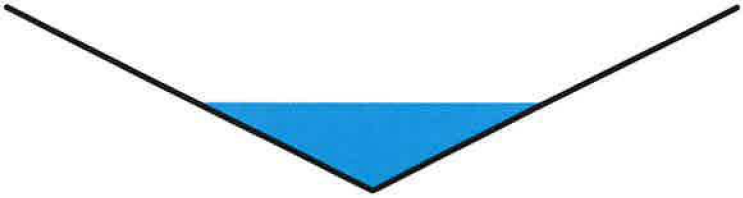
Summary for Reach 10R: RC-2/RC-3

Inflow Area = 5.100 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 8.77 cfs @ 11.97 hrs, Volume= 0.401 af
Outflow = 8.55 cfs @ 12.01 hrs, Volume= 0.401 af, Atten= 2%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.66 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 3.7 min

Peak Storage= 680 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 60.85 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 370.0' Slope= 0.0486 '/'
Inlet Invert= 6,343.00', Outlet Invert= 6,325.00'



Summary for Reach 11R: RC-4

Inflow Area = 9.600 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 17.15 cfs @ 11.96 hrs, Volume= 0.756 af
Outflow = 16.67 cfs @ 12.00 hrs, Volume= 0.756 af, Atten= 3%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.46 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.56 fps, Avg. Travel Time= 4.7 min

Peak Storage= 1,345 cf @ 11.97 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 106.00 cfs

2.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 440.0' Slope= 0.0500 '/'
Inlet Invert= 6,347.00', Outlet Invert= 6,325.00'

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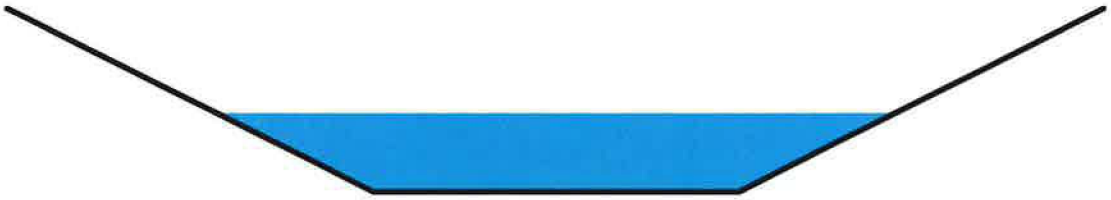
Summary for Reach 12R: RC-5

Inflow Area = 19.500 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 30.00 cfs @ 12.01 hrs, Volume= 1.535 af
Outflow = 29.55 cfs @ 12.04 hrs, Volume= 1.535 af, Atten= 1%, Lag= 1.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.01 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 4.3 min

Peak Storage= 2,017 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.86'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 151.20 cfs

4.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 410.0' Slope= 0.0488 '/'
Inlet Invert= 6,325.00', Outlet Invert= 6,305.00'



Summary for Reach 13R: RC-6

Inflow Area = 4.800 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 6.08 cfs @ 12.06 hrs, Volume= 0.378 af
Outflow = 6.07 cfs @ 12.08 hrs, Volume= 0.378 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.94 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.97 fps, Avg. Travel Time= 1.2 min

Peak Storage= 172 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 73.74 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 140.0' Slope= 0.0714 '/'
Inlet Invert= 6,317.00', Outlet Invert= 6,307.00'

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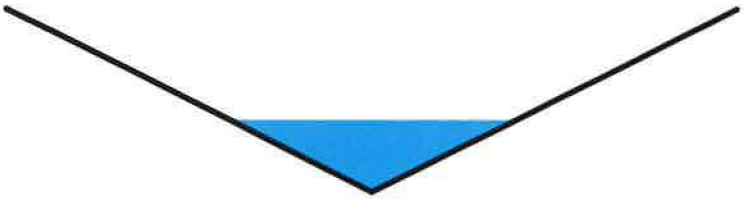


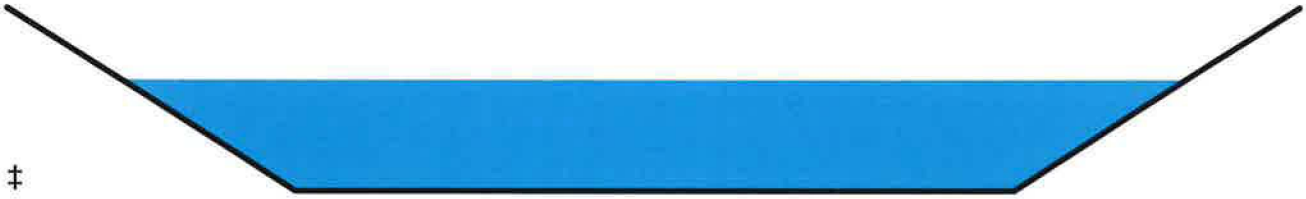
Summary for Reach 14R: RC-7

Inflow Area = 77.600 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 110.42 cfs @ 12.03 hrs, Volume= 6.108 af
Outflow = 110.32 cfs @ 12.03 hrs, Volume= 6.108 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.32 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 0.4 min

Peak Storage= 754 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.21'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 269.94 cfs

10.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 50.0' Slope= 0.0400 '/'
Inlet Invert= 6,308.00', Outlet Invert= 6,306.00'



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Summary for Reach 15R: RC-8/RC-9

Inflow Area = 9.400 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 17.77 cfs @ 11.94 hrs, Volume= 0.740 af
Outflow = 17.68 cfs @ 11.95 hrs, Volume= 0.740 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.52 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.88 fps, Avg. Travel Time= 0.8 min

Peak Storage= 245 cf @ 11.94 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 132.20 cfs

2.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 90.0' Slope= 0.0778 '/'
Inlet Invert= 6,300.00', Outlet Invert= 6,293.00'

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Summary for Reach 16R: RC-10

Inflow Area = 2.300 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 4.51 cfs @ 11.93 hrs, Volume= 0.181 af
Outflow = 4.48 cfs @ 11.93 hrs, Volume= 0.181 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.22 fps, Avg. Travel Time= 0.6 min

Peak Storage= 60 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 106.85 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 80.0' Slope= 0.1500 '/'
Inlet Invert= 6,282.00', Outlet Invert= 6,270.00'

Summary for Reach 17R: RC-11

Inflow Area = 3.700 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-yr, 24-hr event
Inflow = 7.46 cfs @ 11.92 hrs, Volume= 0.291 af
Outflow = 7.38 cfs @ 11.92 hrs, Volume= 0.291 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.76 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.46 fps, Avg. Travel Time= 0.6 min

Peak Storage= 99 cf @ 11.92 hrs
Average Depth at Peak Storage= 0.74'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 104.86 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 90.0' Slope= 0.1444 '/'
Inlet Invert= 6,254.00', Outlet Invert= 6,241.00'

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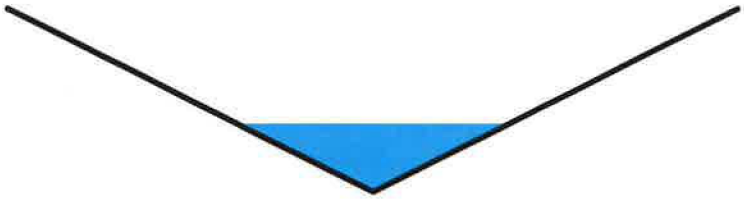

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: RWS-1 Runoff Area=53.500 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=2,800' Slope=0.8580 '/' Tc=6.6 min CN=85 Runoff=178.81 cfs 8.603 af

Subcatchment 2S: RWS-2 Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=1,200' Slope=0.3060 '/' Tc=5.6 min CN=85 Runoff=17.67 cfs 0.820 af

Subcatchment 3S: RWS-3 Runoff Area=9.600 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=1,300' Slope=0.5170 '/' Tc=4.6 min CN=85 Runoff=34.47 cfs 1.544 af

Subcatchment 4S: RWS-4 Runoff Area=77.600 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=4,000' Slope=0.5920 '/' Tc=10.6 min CN=85 Runoff=225.01 cfs 12.478 af

Subcatchment 5S: RWS-5 Runoff Area=4.800 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=1,000' Slope=0.0380 '/' Tc=13.8 min CN=85 Runoff=12.47 cfs 0.772 af

Subcatchment 6S: RWS-6 Runoff Area=9.400 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=400' Slope=0.1760 '/' Tc=3.1 min CN=85 Runoff=35.59 cfs 1.511 af

Subcatchment 7S: RWS-7 Runoff Area=2.300 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=200' Slope=0.1290 '/' Tc=2.1 min CN=85 Runoff=9.01 cfs 0.370 af

Subcatchment 8S: RWS-8 Runoff Area=3.700 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=100' Slope=0.1070 '/' Tc=1.3 min CN=85 Runoff=14.88 cfs 0.595 af

Reach 9R: RC-1 Avg. Flow Depth=1.76' Max Vel=8.71 fps Inflow=178.81 cfs 8.603 af
n=0.040 L=580.0' S=0.0397 '/' Capacity=223.93 cfs Outflow=176.30 cfs 8.603 af

Reach 10R: RC-2/RC-3 Avg. Flow Depth=1.25' Max Vel=5.56 fps Inflow=17.67 cfs 0.820 af
n=0.040 L=370.0' S=0.0486 '/' Capacity=60.85 cfs Outflow=17.36 cfs 0.820 af

Reach 11R: RC-4 Avg. Flow Depth=1.18' Max Vel=6.59 fps Inflow=34.47 cfs 1.544 af
n=0.040 L=440.0' S=0.0500 '/' Capacity=106.00 cfs Outflow=33.80 cfs 1.544 af

Reach 12R: RC-5 Avg. Flow Depth=1.26' Max Vel=7.37 fps Inflow=61.00 cfs 3.136 af
n=0.040 L=410.0' S=0.0488 '/' Capacity=151.20 cfs Outflow=60.29 cfs 3.136 af

Reach 13R: RC-6 Avg. Flow Depth=1.03' Max Vel=5.91 fps Inflow=12.47 cfs 0.772 af
n=0.040 L=140.0' S=0.0714 '/' Capacity=73.74 cfs Outflow=12.45 cfs 0.772 af

Reach 14R: RC-7 Avg. Flow Depth=1.81' Max Vel=9.13 fps Inflow=225.01 cfs 12.478 af
n=0.040 L=50.0' S=0.0400 '/' Capacity=269.94 cfs Outflow=224.84 cfs 12.478 af

Reach 15R: RC-8/RC-9 Avg. Flow Depth=1.09' Max Vel=7.86 fps Inflow=35.59 cfs 1.511 af
n=0.040 L=90.0' S=0.0778 '/' Capacity=132.20 cfs Outflow=35.43 cfs 1.511 af

Reach 16R: RC-10 Avg. Flow Depth=0.79' Max Vel=7.20 fps Inflow=9.01 cfs 0.370 af
n=0.040 L=80.0' S=0.1500 '/' Capacity=106.85 cfs Outflow=8.96 cfs 0.370 af

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Reach 17R: RC-11 Avg. Flow Depth=0.96' Max Vel=8.04 fps Inflow=14.88 cfs 0.595 af
n=0.040 L=90.0' S=0.1444 '/' Capacity=104.86 cfs Outflow=14.76 cfs 0.595 af

Total Runoff Area = 166.000 ac Runoff Volume = 26.692 af Average Runoff Depth = 1.93"
100.00% Pervious = 166.000 ac 0.00% Impervious = 0.000 ac

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Summary for Subcatchment 1S: RWS-1

Runoff = 178.81 cfs @ 11.98 hrs, Volume= 8.603 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

	Area (ac)	CN	Description
*	53.500	85	
	53.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	2,800	0.8580	7.04		**Lag/CN Method, RWS-1**

Summary for Subcatchment 2S: RWS-2

Runoff = 17.67 cfs @ 11.97 hrs, Volume= 0.820 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

	Area (ac)	CN	Description
*	5.100	85	
	5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	1,200	0.3060	3.55		**Lag/CN Method, RWS-2**

Summary for Subcatchment 3S: RWS-3

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Runoff = 34.47 cfs @ 11.96 hrs, Volume= 1.544 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

	Area (ac)	CN	Description
*	9.600	85	
	9.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	1,300	0.5170	4.69		**Lag/CN Method, RWS-3**

Summary for Subcatchment 4S: RWS-4

Runoff = 225.01 cfs @ 12.02 hrs, Volume= 12.478 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

Area (ac)	CN	Description
* 77.600	85	
77.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	4,000	0.5920	6.28		**Lag/CN Method, RWS-4**

Summary for Subcatchment 5S: RWS-5

Runoff = 12.47 cfs @ 12.06 hrs, Volume= 0.772 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

Area (ac)	CN	Description
* 4.800	85	
4.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	1,000	0.0380	1.21		**Lag/CN Method, RWS-5**

Summary for Subcatchment 6S: RWS-6

Runoff = 35.59 cfs @ 11.94 hrs, Volume= 1.511 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

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Area (ac)	CN	Description
* 9.400	85	
9.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	400	0.1760	2.16		**Lag/CN Method, RWS-6**

Summary for Subcatchment 7S: RWS-7

Runoff = 9.01 cfs @ 11.93 hrs, Volume= 0.370 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

Area (ac)	CN	Description
* 2.300	85	
2.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	200	0.1290	1.61		**Lag/CN Method, RWS-7**

Summary for Subcatchment 8S: RWS-8

Runoff = 14.88 cfs @ 11.92 hrs, Volume= 0.595 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=3.40"

Area (ac)	CN	Description
* 3.700	85	
3.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.1070	1.28		**Lag/CN Method, RWS-8**

Summary for Reach 9R: RC-1

Inflow Area = 53.500 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 178.81 cfs @ 11.98 hrs, Volume= 8.603 af
Outflow = 176.30 cfs @ 12.01 hrs, Volume= 8.603 af, Atten= 1%, Lag= 1.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.71 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 2.03 fps, Avg. Travel Time= 4.8 min

Peak Storage= 11,754 cf @ 11.99 hrs
Average Depth at Peak Storage= 1.76'
Bank-Full Depth= 2.00' Flow Area= 24.0 sf, Capacity= 223.93 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 580.0' Slope= 0.0397 '/'
Inlet Invert= 6,334.00', Outlet Invert= 6,311.00'

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Summary for Reach 10R: RC-2/RC-3

Inflow Area = 5.100 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 17.67 cfs @ 11.97 hrs, Volume= 0.820 af
Outflow = 17.36 cfs @ 12.00 hrs, Volume= 0.820 af, Atten= 2%, Lag= 1.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.56 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.90 fps, Avg. Travel Time= 3.2 min

Peak Storage= 1,156 cf @ 11.98 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 60.85 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 370.0' Slope= 0.0486 '/'
Inlet Invert= 6,343.00', Outlet Invert= 6,325.00'

Summary for Reach 11R: RC-4

Inflow Area = 9.600 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 34.47 cfs @ 11.96 hrs, Volume= 1.544 af
Outflow = 33.80 cfs @ 11.99 hrs, Volume= 1.544 af, Atten= 2%, Lag= 1.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.59 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 4.0 min

Peak Storage= 2,260 cf @ 11.97 hrs
Average Depth at Peak Storage= 1.18'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 106.00 cfs

2.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 440.0' Slope= 0.0500 '/'
Inlet Invert= 6,347.00', Outlet Invert= 6,325.00'

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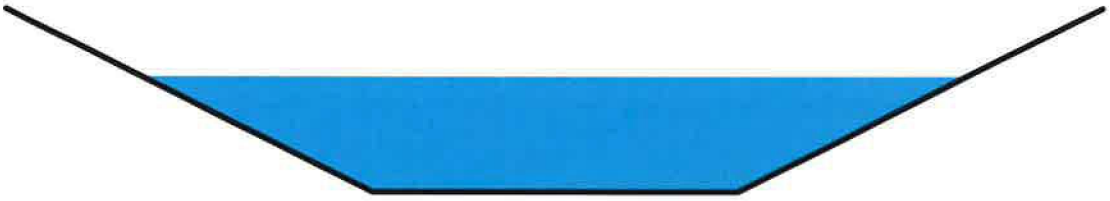
Summary for Reach 12R: RC-5

Inflow Area = 19.500 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 61.00 cfs @ 12.00 hrs, Volume= 3.136 af
Outflow = 60.29 cfs @ 12.02 hrs, Volume= 3.136 af, Atten= 1%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.37 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.92 fps, Avg. Travel Time= 3.6 min

Peak Storage= 3,360 cf @ 12.01 hrs
Average Depth at Peak Storage= 1.26'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 151.20 cfs

4.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 410.0' Slope= 0.0488 '/'
Inlet Invert= 6,325.00', Outlet Invert= 6,305.00'



Summary for Reach 13R: RC-6

Inflow Area = 4.800 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 12.47 cfs @ 12.06 hrs, Volume= 0.772 af
Outflow = 12.45 cfs @ 12.07 hrs, Volume= 0.772 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.91 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 1.0 min

Peak Storage= 295 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.03'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 73.74 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 140.0' Slope= 0.0714 '/'
Inlet Invert= 6,317.00', Outlet Invert= 6,307.00'

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Summary for Reach 14R: RC-7

Inflow Area = 77.600 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 225.01 cfs @ 12.02 hrs, Volume= 12.478 af
Outflow = 224.84 cfs @ 12.03 hrs, Volume= 12.478 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.13 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.36 fps, Avg. Travel Time= 0.4 min

Peak Storage= 1,232 cf @ 12.02 hrs
Average Depth at Peak Storage= 1.81'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 269.94 cfs

10.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 50.0' Slope= 0.0400 '/'
Inlet Invert= 6,308.00', Outlet Invert= 6,306.00'

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Summary for Reach 15R: RC-8/RC-9

Inflow Area = 9.400 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 35.59 cfs @ 11.94 hrs, Volume= 1.511 af
Outflow = 35.43 cfs @ 11.94 hrs, Volume= 1.511 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.86 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.22 fps, Avg. Travel Time= 0.7 min

Peak Storage= 407 cf @ 11.94 hrs
Average Depth at Peak Storage= 1.09'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 132.20 cfs

2.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 90.0' Slope= 0.0778 '/'
Inlet Invert= 6,300.00', Outlet Invert= 6,293.00'

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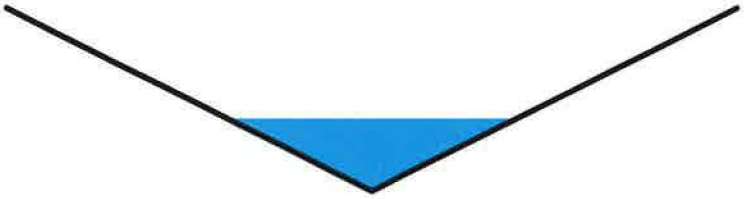
Summary for Reach 16R: RC-10

Inflow Area = 2.300 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 9.01 cfs @ 11.93 hrs, Volume= 0.370 af
Outflow = 8.96 cfs @ 11.93 hrs, Volume= 0.370 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.20 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.50 fps, Avg. Travel Time= 0.5 min

Peak Storage= 100 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 106.85 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 80.0' Slope= 0.1500 '/'
Inlet Invert= 6,282.00', Outlet Invert= 6,270.00'



Summary for Reach 17R: RC-11

Inflow Area = 3.700 ac, 0.00% Impervious, Inflow Depth = 1.93" for 100-yr, 24-hr event
Inflow = 14.88 cfs @ 11.92 hrs, Volume= 0.595 af
Outflow = 14.76 cfs @ 11.92 hrs, Volume= 0.595 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.04 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.78 fps, Avg. Travel Time= 0.5 min

Peak Storage= 166 cf @ 11.92 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 104.86 cfs

0.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 90.0' Slope= 0.1444 '/'
Inlet Invert= 6,254.00', Outlet Invert= 6,241.00'

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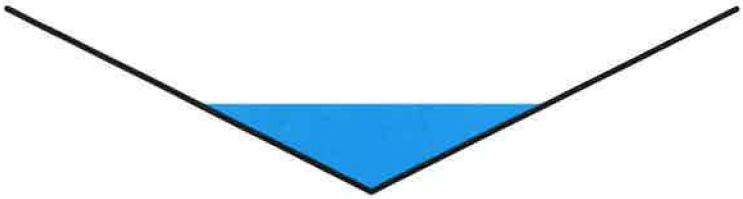

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RIPRAP SIZING BASED ON HEC-11

Bank angle = 2 :1 = 26.57 degrees = 0.464 radians
Rpirap material angle of repose = 39 degrees = 0.681 radians

K1 = 0.704

Channel	Design Velocity (ft/s)	Flow Depth (ft)	Median Riprap Diameter		
			Calculated (ft)	Calculated (in)	Planned (in)
RC-1	8.71	1.76	0.844	10.1	12
RC-2	5.56	1.25	0.261	3.1	4
RC-3	5.56	1.25	0.261	3.1	4
RC-4	6.59	1.18	0.446	5.4	6
RC-5	7.37	1.26	0.604	7.3	9
RC-6	5.91	1.03	0.345	4.1	4
RC-7	9.13	1.81	0.959	11.5	12
RC-8	7.86	1.09	0.788	9.5	9
RC-9	7.86	1.09	0.788	9.5	9
RC-10	7.20	0.79	0.712	8.5	9
RC-11	8.04	0.96	0.899	10.8	12

Reference:

Brown, S.A. and E,S, Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. U.S. Departmnt of Transportation, Federal Highway Administration. McLean, Virginia.

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CHAPTER 8
BONDING AND INSURANCE

8.10 Bonding Definitions and Division Responsibilities

This chapter provides information regarding the bonding for coal recovery and reclamation operations at the Deer Creek waste rock site (the "Deer Creek site" or the "site"). The applicant has on file with the Utah Division of Oil, Gas and Mining a bond made payable to the Utah Division of Oil, Gas and Mining for performance of all the requirements of the State Program.

8.20 Requirement to File a Bond

The area covered by the bond is outlined on Plate 5-1, which includes all disturbed areas. The disturbed areas and specific acres to be reclaimed are indicated on Plate 5-3. The performance bond period is for the duration of the coal recovery and reclamation operations. The bond is in the form of a surety bond and is described in Section 8.60.

8.30 Determination of Bond Amount

The bond amount was determined by using unit costs obtained from RS Means Heavy Construction Cost Data, adjusted for the Price, Utah area. The total estimated bond amount is indicated in Appendix 8-1. The present bond is sufficient to assure the completion of the reclamation plan.

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The reader is encouraged to look at Plate 5-3 when reviewing the bond estimate provided in Appendix 8-1. This Plate generally notes the location of the future reject pile (i.e., within the boundary of the current waste rock pile) as well as the corridor in which the site access road currently exists. Additional information regarding the current location of the waste rock pile and the site access road is provided on Plate 5-1.

The reader is also encouraged to notice the shaded headings at the top of each subsection of the bond estimate provided in Appendix 8-1. For instance, a shaded heading entitled "Construct Reclamation Channels at Reject Pile" appears on the first page of the spreadsheet in Appendix 8-1. That subsection then presents cost estimates to construct reclamation channels RC-1 through RC-6. The locations of these reclamation channels are shown on Plate 5-3.

8.40 General Terms and Conditions of the Bond

The performance bond is in the amount determined by the Utah Division of Oil, Gas and Mining as described in Section 8.30 and payable to the Division. In the event the surety company becomes insolvent, the Division will be notified by the permittee. The surety company and permittee will notify the Division of any changes in the bonding terms for BRC Wellington ("BRCW"). The duration of the bond is described in Section 8.20.

8.50 Bonding Requirements

If required, the applicant will comply with the stipulation that bond coverage be extended 30 days prior to the expiration of the bond term. Under these conditions, a performance bond for a new term will be submitted to the Division at least 30 days prior to expiration of coverage.

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8.60 Forms of Bonds

Upon acceptance of this permit application by the Utah Division of Oil, Gas and Mining, a surety bond for the applicant will be executed by a corporate surety licensed to do business in Utah. The surety bond will be non-cancellable during its term except with the prior consent of the Utah Division of Oil, Gas and Mining.

8.70 Replacement of Bonds

BRCW does not currently plan to replace the bond for the permit area. However, should a replacement bond be required, the replacement bond will be submitted to and approved by the Division prior to the cancellation of the original bond.

8.80 Requirements to Release Performance Bonds

The applicant will comply with the requirements described in Section R-645-301-880 the Utah regulations when applying for the release of performance bonds.

8.90 Terms and Conditions for Liability Insurance

A Certificate of Insurance applicable to the Deer Creek site is provided in Appendix 1-2 of this application. The policy provides for personal injury and property damage protection consistent with the amounts designated in R645-301-890.100.

The insurance policy will be maintained in full force during the life of the permit, including the liability period necessary to complete all reclamation operations. The policy will include a rider stating that the Utah Division of Oil, Gas and Mining be notified of any changes in the policy, including termination or failure to renew.

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APPENDIX 8-1

Reclamation Bond Cost Estimate

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Bond Summary

Direct Costs

Demolition & Earthwork	$316,692.00	
Revegetation	$186,843.50	
Sub Total Direct Costs 2015 dollars	$503,535.50	

Indirect Costs

Mob/Demob	$50,354.00	10.0%
Contingency	$25,177.00	5.0%
Engineering Redesign	$12,588.00	2.5%
Main Office Expense	$34,240.00	6.8%
Project Mainagement Fee	$12,588.00	2.5%
Subtotal Indirect Costs 2015 Dollars	$134,947.00	26.8%
Total Reclamation Cost 2015 Dollars	**$638,482.50**	
Escalation factor for 2015		0.012
Number of years		6
Escalation	$47,372.00	
Total Escalated Reclamation Cost 2021 Dollars	$685,854.50	
Bond Amount (rounded to nearest $1,000)	**$686,000.00**	
Bond Posted (enter date)	$686,000.00	
Difference Between Cost Estimate and Bond	$0.00	
Percent Difference	0.00%	

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Ref.	Description	Cost
1	Temporary Sediment Controls	$16,302
2	Grade Reject Pile	$35,936
3	RC-1	$77,380
4	RC-2	$22,007
5	RC-3	$8,071
6	RC-4	$48,771
7	RC-5	$52,857
8	RC-6	$3,345
10	Reclaim Access Rd	$20,758
11	RC-7	$9,033
12	RC-8	$5,976
13	RC-9	$5,976
14	RC-10	$5,140
15	RC-11	$5,140
	Total	**$316,692**

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	Linked costs Cost Factors	RSMeans Cost		
Means Number	**Materials**	**$ 2,015.00**	**Units**	**crew**
31 25 14.16 1000	Silt Fence, install and maintain, remove	$ 1.61	lf	b-62
31 25 14.16 1100	25% per month for maintenance; 6 mon max life	$ 0.40	lf	
31 37 13.10 0100	Machine placed for lsope protection	$ 52.90	lcy	b-12g
31 23 23.20 2500	Dust Control, light	$ 820.00	day	b-59
32 01 16.71 5320	Asphalt removal, rip, and sweep 1"-3", no haul	$ 0.53	sy	b-70
31 23 23.20 1014	12 CY, 15 mph, 10 min watit cycle 0.5 mi	$ 3.07	lcy	b-34b
31 23 23.14 4220	200 HP hual , common earth	$ 1.76	lcy	b-10b
31 23 23.23 6050	12" lifts 2 passes, toed sheepsfoot	$ 0.39	ecy	b-10d
Crew B-10D	Equip Oper, laborer, dozer, vib roller	$ 2,839.48	day	
31 23 16.13 0610	common earth 6'-10 1-1/2 CY excavator	$ 2.91	bcy	b-12b
31 23 23.20 1096	haul w/ 12 CY 45 pmh, 10 miles	$ 4.96	lcy	b-34b
31 23 23.15 5060	Frt End Ldr 1-1/2 CY bucket	$ 21.88	bcy	b-12S
31 23 23.14 4020	backfill 200hp 50' haul, common earth	$ 0.88	lcy	b-10b
31 23 16.13 1000	10'-14' deep 1-1/2 CY excavator	$ 3.23	bcy	b-12b
31 23 16.13 0130	4'-6' deep 1-1/2 CY excavator	$ 3.23	bcy	b-12b
31 14 13.23 1420	toposoil removed and stockpile	$ 2.24	cy	b-10b
31 23 23.14 4440	Backfill from stockpile, 200 HP, 300' haul clay	$ 2.94	lcy	b-10b
Crew B-12a	equip Oper, laborer, hyd excavator	$ 1,984.26	daily	
32 92 19.14 5400	Seeding utility mix hydroseeding with mulch and fert	$ 57.00	msf	b-81
31 23 16.46 4220	excavate 200 HP, 150' haul common earth	$ 3.77	cy	

NOTES: 2015 RS Means unit costs utlized

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
01	**Temporary Sediment Controls**																			
	Install and remove silt fencing for temporary sed control	Silt Fence, install and maintain,	31 25 14.16 1000	1.61	lf	3500										LF		3500	LF	$5,635
	Maintain silt fencing for 2 months	maintenance; 6 mon	31 25 14.16 1100	0.4025	lf	3500										LF		3500	LF	$1,409
	install stable site entrance at north edge of paved site road	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						20					CY		20	CY	$1,058
	provide water truck for dust control as needed	Dust Control, light	31 23 23.20 2500	820	day									10		day		10	day	$8,200
	Subtotal																			$16,302
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$16,302**

Notes: See Plate 5-1 within the MRP for surface facilities details.

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
02	**Grade Reject Pile**																			
	Remove asphalt from access road (rip, load, and sweep)	Asphalt removal, rip, and sweep 1"-3", no haul	32 01 16.71 5320	0.53	sy					7200						SY		7200	SY	$3,816
	haul waste asphalt to reject pile (12CY, 15mph avg spd)	12 CY, 15 mph, 10 min watit cycle 0.5 mi	31 23 23.20 1014	3.07	lcy						600					CY		600	CY	$1,842
	doze rejected material into sed pond (200 hp)	200 HP hual , common earth	31 23 23.14 4220	1.76	lcy						8800					CY		8800	CY	$15,488
	Compact reject material in sed pond (12"lifts, sheepsfoot roller)	12" lifts 2 passes, toed sheepsfoot	31 23 23.23 6050	0.39	ecy						8800					CY		8800	CY	$3,432
	General Grading and compaction at pile (200hp dozer w/ roller)	Equip Oper, laborer, dozer, vib roller	Crew B-10D	2839.48	day									4		Day		4	Day	$11,358
	Subtotal																			$35,936
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$35,936**

Notes: See Plate 5-1 within the MRP for surface facilities details.

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
03	**RC-1**																			
	RC-1 Excavation	common earth 6'-10 1-1/2 CY excavator	31 23 16.13 0610	2.91	bcy						4440					CY		4440	CY	$12,920
	RC-1 haul filter material 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						425					CY		425	CY	$2,108
	RC-1 purchase place filter layer	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						425					CY		425	CY	$9,299
	RC-1 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						850					CY		850	CY	$4,216
	RC-1 purchase/place riprap	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						850					CY		850	CY	$44,965
	RC-1 spread excess reject	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						4400					CY		4400	CY	$3,872
	Subtotal																			$77,380
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$77,380**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
04	**RC-2**																			
	RC-2 Excavation	10'-14' deep 1-1/2 CY excavator	31 23 16.13 1000	3.23	bcy						3620					CY		3620	CY	$11,693
	RC-2 haul filter material 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						50					CY		50	CY	$248
	RC-2 purchase place filter layer	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						50					CY		50	CY	$1,094
	RC-2 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						100					CY		100	CY	$496
	RC-2 purchase/place riprap	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						100					CY		100	CY	$5,290
	RC-2 spread excess reject	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						3620					CY		3620	CY	$3,186
	Subtotal																			$22,007
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$22,007**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
05	**RC-3**																			
	RC-3 Excavation	10'-14' deep 1-1/2 CY excavator	31 23 16.13 1000	3.23	bcy						1270					CY		1270	CY	$4,102
	RC-3 haul filter material 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						20					CY		20	CY	$99
	RC-3 purchase place filter layer	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						20					CY		20	CY	$438
	RC-3 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						40					CY		40	CY	$198
	RC-3 purchase/place riprap	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						40					CY		40	CY	$2,116
	RC-3 spread excess reject	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						1270					CY		1270	CY	$1,118
	Subtotal																			$8,071
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$8,071**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
06	**RC-4**																			
	RC-4 Excavation	10'-14' deep 1-1/2 CY excavator	31 23 16.13 1000	3.23	bcy						5870					CY		5870	CY	$18,960
	RC-4 haul filter material 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						425					CY		425	CY	$2,108
	RC-4 purchase place filter layer	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						160					CY		160	CY	$3,501
	RC-4 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						425					CY		425	CY	$2,108
	RC-4 purchase/place riprap	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						320					CY		320	CY	$16,928
	RC-4 spread excess reject	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						5870					CY		5870	CY	$5,166
	Subtotal																			$43,771
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$43,771**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
07	**RC-5**																			
	RC-5 Excavation	10'-14' deep 1-1/2 CY excavator	31 23 16.13 1000	3.23	bcy						3720					CY		3720	CY	$12,016
	RC-5 haul filter material 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						245					CY		245	CY	$1,215
	RC-5 purchase place filter layer	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						245					CY		245	CY	$5,361
	RC-5 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						490					CY		490	CY	$2,430
	RC-5 purchase/place riprap	Machine placed for !sope protection	31 37 13.10 0100	52.9	lcy						490					CY		490	CY	$25,921
	RC-5 spread excess reject	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						6720					CY		6720	CY	$5,914
	Subtotal																			$52,857
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$52,857**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
08	**RC-6**																			
	RC-6 Excavation	4'-6' deep 1-1/2 CY excavator	31 23 16.13 0130	3.23	bcy						120					CY		120	CY	$388
	RC-6 haul filter material 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						20					CY		20	CY	$99
	RC-6 purchase place filter layer	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						20					CY		20	CY	$438
	RC-6 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						40					CY		40	CY	$198
	RC-6 purchase/place riprap	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						40					CY		40	CY	$2,116
	RC-6 spread excess reject	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						120					CY		120	CY	$106
	Subtotal																			$3,345
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$3,345**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
10	**Reclaim Access Rd**																			
	grade fill materials into cuts	excavate 200 HP, 150' haul common earth	31 23 16.46 4220	3.77	cy						4990					CY		4990	CY	$18,812
	compact new fill material	12" lifts 2 passes, toed sheepsfoot	31 23 23.23 6050	0.39	ecy						4990					CY		4990	CY	$1,946
	Subtotal																			$20,758
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$20,758**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
11	**RC-7**																			
	RC-7 Excavation	4'-6' deep 1-1/2 CY excavator	31 23 16.13 0130	3.23	bcy						290					CY		290	CY	$937
	RC-7 haul filter material 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						55					CY		55	CY	$273
	RC-7 purchase place filter layer	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						55					CY		55	CY	$1,203
	RC-7 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						110					CY		110	CY	$546
	RC-7 purchase/place riprap	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						110					CY		110	CY	$5,819
	RC-7 spread excess reject	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						290					CY		290	CY	$255
	Subtotal																			$9,033
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$9,033**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
12	**RC-8**																			
	RC-8 Excavation	4'-6' deep 1-1/2 CY excavator	31 23 16.13 0130	3.23	bcy						240					CY		240	CY	$775
	RC-8 haul filter material 1	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						35					CY		35	CY	$174
	RC-8 purchase place filter	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						35					CY		35	CY	$766
	RC-8 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						70					CY		70	CY	$347
	RC-8 purchase/place ripra	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						70					CY		70	CY	$3,703
	RC-8 spread excess rejec	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						240					CY		240	CY	$211
	Subtotal																			$5,976
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$5,976**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
13	**RC-9**																			
	RC-9 Excavation	4'-6' deep 1-1/2 CY excavator	31 23 16.13 0130	3.23	bcy						240					CY		240	CY	$775
	RC-9 haul filter material 1	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						35					CY		35	CY	$174
	RC-9 purchase place filter	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						35					CY		35	CY	$766
	RC-9 haul riprap, 10 mi rt	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						70					CY		70	CY	$347
	RC-9 purchase/place ripra	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						70					CY		70	CY	$3,703
	RC-9 spread excess rejec	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						240					CY		240	CY	$211
	Subtotal																			$5,976
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$5,976**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
14	**RC-10**																			
	RC-10 Excavation	4'-6' deep 1-1/2 CY excavator	31 23 16.13 0130	3.23	bcy						210					CY		210	CY	$678
	RC-10 haul filter material	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						30					CY		30	CY	$149
	RC-10 purchase place filte	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						30					CY		30	CY	$656
	RC-10 haul riprap, 10 mi r	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						60					CY		60	CY	$298
	RC-10 purchase/place ripr	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						60					CY		60	CY	$3,174
	RC-10 spread excess reje	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						210					CY		210	CY	$185
	Subtotal																			$5,140
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$5,140**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
15	**RC-11**																			
	RC-11 Excavation	4'-6' deep 1-1/2 CY excavator	31 23 16.13 0130	3.23	bcy						210					CY		210	CY	$678
	RC-11 haul filter material	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						30					CY		30	CY	$149
	RC-11 purchase place filte	Frt End Ldr 1-1/2 CY bucket	31 23 23.15 5060	21.88	bcy						30					CY		30	CY	$656
	RC-11 haul riprap, 10 mi r	haul w/ 12 CY 45 pmh, 10 miles	31 23 23.20 1096	4.96	lcy						60					CY		60	CY	$298
	RC-11 purchase/place rip	Machine placed for lsope protection	31 37 13.10 0100	52.9	lcy						60					CY		60	CY	$3,174
	RC-11 spread excess reje	backfill 200hp 50' haul, common earth	31 23 23.14 4020	0.88	lcy						210					CY		210	CY	$185
	Subtotal																			$5,140
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$5,140**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	*Description*	*Cost*
9	Cover Reject Pile	$165,238
16	Seed Access Road	$21,606
	Total	**$186,844**

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	Linked costs Cost Factors	RSMeans Cost		
Means Number	**Materials**	**$ 2,015.00**	**Units**	**crew**
31 25 14.16 1000	Silt Fence, install and maintain, remove	$ 1.61	lf	b-62
31 25 14.16 1100	25% per month for maintenance; 6 mon max life	$ 0.40	lf	
31 37 13.10 0100	Machine placed for lsope protection	$ 52.90	lcy	b-12g
31 23 23.20 2500	Dust Control, light	$ 820.00	day	b-59
32 01 16.71 5320	Asphalt removal, rip, and sweep 1"-3", no haul	$ 0.53	sy	b-70
31 23 23.20 1014	12 CY, 15 mph, 10 min watit cycle 0.5 mi	$ 3.07	lcy	b-34b
31 23 23.14 4220	200 HP hual , common earth	$ 1.76	lcy	b-10b
31 23 23.23 6050	12" lifts 2 passes, toed sheepsfoot	$ 0.39	ecy	b-10d
Crew B-10D	Equip Oper, laborer, dozer, vib roller	$ 2,839.48	day	
31 23 16.13 0610	common earth 6'-10 1-1/2 CY excavator	$ 2.91	bcy	b-12b
31 23 23.20 1096	haul w/ 12 CY 45 pmh, 10 miles	$ 4.96	lcy	b-34b
31 23 23.15 5060	Frt End Ldr 1-1/2 CY bucket	$ 21.88	bcy	b-12S
31 23 23.14 4020	backfill 200hp 50' haul, common earth	$ 0.88	lcy	b-10b
31 23 16.13 1000	10'-14' deep 1-1/2 CY excavator	$ 3.23	bcy	b-12b
31 23 16.13 0130	4'-6' deep 1-1/2 CY excavator	$ 3.23	bcy	b-12b
31 14 13.23 1420	toposoil removed and stockpile	$ 2.24	cy	b-10b
31 23 23.14 4440	Backfill from stockpile, 200 HP, 300' haul clay	$ 2.94	lcy	b-10b
Crew B-12a	equip Oper, laborer, hyd excavator	$ 1,984.26	daily	
32 92 19.14 5400	Seeding utility mix hydroseeding with mulch and fert	$ 57.00	msf	b-81
31 23 16.46 4220	excavate 200 HP, 150' haul common earth	$ 3.77	cy	

NOTES: 2015 RS Means unit costs utlized

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Descritption
Install and remove silt fencing for temporary sed control
Maintain silt fencing for 2 months
install stable site entrance at north edge of paved site road
provide water truck for dust control as needed
Remove asphalt from access road (rip, load, and sweep)
haul waste asphalt to reject pile (12CY, 15mph avg spd)
doze rejected material into sed pond (200 hp)
Compact reject material in sed pond (12"lifts, sheepsfoot roller)
General Grading and compaction at pile (200hp dozer w/ roller)
RC-1 Excavation
RC-1 haul filter material 10 mi rt
RC-1 purchase place filter layer
RC-1 haul riprap, 10 mi rt
RC-1 purchase/place riprap
RC-1 spread excess reject
RC-2 Excavation
RC-2 haul filter material 10 mi rt
RC-2 purchase place filter layer
RC-2 haul riprap, 10 mi rt
RC-2 purchase/place riprap
RC-2 spread excess reject
RC-3 Excavation
RC-3 haul filter material 10 mi rt
RC-3 purchase place filter layer
RC-3 haul riprap, 10 mi rt
RC-3 purchase/place riprap
RC-3 spread excess reject
RC-4 Excavation
RC-4 haul filter material 10 mi rt
RC-4 purchase place filter layer
RC-4 haul riprap, 10 mi rt
RC-4 purchase/place riprap
RC-4 spread excess reject
RC-5 Excavation
RC-5 haul filter material 10 mi rt
RC-5 purchase place filter layer
RC-5 haul riprap, 10 mi rt
RC-5 purchase/place riprap
RC-5 spread excess reject
RC-6 Excavation
RC-6 haul filter material 10 mi rt
RC-6 purchase place filter layer
RC-6 haul riprap, 10 mi rt

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RC-6 purchase/place riprap
RC-6 spread excess reject
segregate topsoil from existing soil stockpiles
spread subsoil over regraded reject pile
compact subsoil
spread topsoil over subsoil
gouge soil
hydroseed area, w/ mulch
grade fill materials into cuts
compact new fill material
RC-7 Excavation
RC-7 haul filter material 10 mi rt
RC-7 purchase place filter layer
RC-7 haul riprap, 10 mi rt
RC-7 purchase/place riprap
RC-7 spread excess reject
RC-8 Excavation
RC-8 haul filter material 10 mi rt
RC-8 purchase place filter layer
RC-8 haul riprap, 10 mi rt
RC-8 purchase/place riprap
RC-8 spread excess reject
RC-9 Excavation
RC-9 haul filter material 10 mi rt
RC-9 purchase place filter layer
RC-9 haul riprap, 10 mi rt
RC-9 purchase/place riprap
RC-9 spread excess reject
RC-10 Excavation
RC-10 haul filter material 10 mi rt
RC-10 purchase place filter layer
RC-10 haul riprap, 10 mi rt
RC-10 purchase/place riprap
RC-10 spread excess reject
RC-6 Excavation
RC-6 haul filter material 10 mi rt
RC-6 purchase place filter layer
RC-6 haul riprap, 10 mi rt
RC-6 purchase/place riprap
RC-6 spread excess reject

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
09	**Cover and Seed Reject Pile**																			
	segregate topsoil from existing soil stockpiles	toposoil removed and stockpile	31 14 13.23 1420	2.24	cy						2303					CY		2303	CY	$5,159
	spread subsoil over regraded reject pile	Backfill from stockpile, 200 HP, 300' haul clay	31 23 23.14 4440	2.94	lcy						33898					CY		33898	CY	$99,660
	compact subsoil	12" lifts 2 passes, toed sheepsfoot	31 23 23.23 6050	0.39	ecy						22600					CY		22600	CY	$8,814
	spread topsoil over subsoil	Backfill from stockpile, 200 HP, 300' haul clay	31 23 23.14 4440	2.94	lcy						2303					CY		2303	CY	$6,771
	gouge soil	equip Oper, laborer, hyd excavator	Crew B-12a	1984	daily									5		Day		5	Day	$9,921
	hydroseed area, w/ mulch	Seeding utility mix hydroseeding with mulch and fert	32 92 19.14 5400	57	msf					490						MSF		490	MSF	$27,930
	25% Reseed									490						MSF		490	MSF	$6,983
	Subtotal																			$165,238
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$165,238**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
10	**Reclaim Access Rd**																			
	gouge soil	equip Oper, laborer, hyd excavator	Crew B-12a	1984	daily									5		Day		5	Day	$9.921
	hydroseed area, w/ mulch	Seeding utility mix hydroseeding with	32 92 19.14 5400	57	msf					164						MSF		164	MSF	$9,348
	25% Reseed									164						MSF		164	MSF	$2,337
	Subtotal																			$21,606
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$21,606**

Notes: See Plate 5-1 within the MRP for surface facilities details. Volumes from Civil3D CAD surfaces

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CHAPTER 9
ALLUVIAL VALLEY FLOORS

The Deer Creek site is located in an upland area overlain by a thin veneer of colluvial, slope wash deposits. It is not located within or adjacent to an alluvial valley floor.

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NORTH SOIL STOCKPILE
TOPSOIL = 1,317 YD^3
SUBSOIL = 19,000 YD^3

PERMIT AREA BOUNDARY

SOUTH SOIL STOCKPILE
TOPSOIL = 966 YD^3
SUBSOIL = 14,898 YD^3

PERMIT AREA BOUNDARY

LEGEND

MAXIMUM SOIL STRIPPING DEPTH

- ZERO
- 6 INCHES
- 12 INCHES
- 18 INCHES
- 24 INCHES

SOIL SAMPLE LOCATION (SAMPLED APRIL 1987)

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REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
22 Aug 2016
STATE OF UTAH

REVISION	
DATE	BY

BRC Wellington, LLC

APPROXIMATE SOIL STRIPPING DEPTHS AND STOCKPILE LOCATIONS

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE: 1"=100'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER PLATE 2-1

0' 100'

GARDNER SALTBUSH/MAT SALTBUSH REFERENCE AREA

GARDNER SALTBUSH/MAT SALTBUSH SAMPLE AREA

GARDNER SALTBUSH/MAT SALTBUSH COMMUNITY

PERMIT AREA BOUNDARY

4" WET WEATHER SEEP DRAIN PIPE

SEDIMENT POND WATER LEVEL 6316

POND

FENCE

W.E. 6260.85

W.E. 6242.66

LEGEND

PINYON-JUNIPER COMMUNITY (PRE-CONSTRUCTION)

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AUG 11 2016
Div. of Oil, Gas & Mining

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

0' 100'

REVISION	
DATE	BY

BRC Wellington, LLC

VEGETATION MAP

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE: 1"=100'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER PLATE 3-1

PERMIT AREA BOUNDARY

ELK BEDDING GROUNDS

DEER/ELK CRITICAL WINTER RANGE

SEDIMENT POND WATER LEVEL 6318'

4" WET WEATHER SEEP DRAIN PIPE

CHANNEL 1B

TRAIL

FENCE

POND

W.E. 6260.85

W.E. 6242.66

HIGHWAY 31

31

LEGEND

- DEER/ELK CRITICAL WINTER RANGE
- ELK BEDDING GROUNDS
- DEER/ELK TRAIL

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NOTE
WILDLIFE HABITAT DESIGNATIONS WERE DETERMINED THROUGH PERSONAL COMMUNICATION WITH LARRY DALTON (RESOURCE ANALYST, UDWR) AND FIELD INVESTIGATIONS BY VAL PAYNE (WILDLIFE BIOLOGIST, UP&L).

REGISTERED PROFESSIONAL ENGINEER
No. 166246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
22 Aug 2016
STATE OF UTAH

0' 100'

REVISION	
DATE	BY

BRC Wellington, LLC

WILDLIFE HABITAT MAP

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE: 1"=100'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER PLATE 3-2

PERMIT AREA BOUNDARY

UD-3

UD-2

NORTH SOIL STOCKPILE

EXISTING WASTE ROCK PILES (APPROX. 306,700 CY TOTAL)

TEMPORARY PILE ACCESS ROADWAY

4" WET WEATHER SEEP DRAIN PIPE

SEDIMENT POND MAX. WATER LEVEL 6318.0

UD-4

EXISTING DRAINAGE CHANNEL

SOUTH SOIL STOCKPILE

UD-1

UC-6 (18" ø CULVERT)

UC-1 (18" ø CULVERT)

PERMIT AREA BOUNDARY

UC-2 (18" ø CULVERT)

UD-5

UC-3 (18" ø CULVERT)

UD-6

UC-4 (18" ø CULVERT)

UD-7

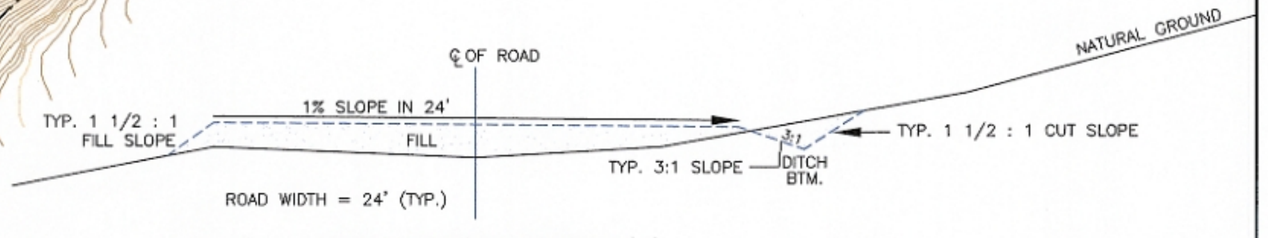
UC-5 (18" ø CULVERT)

STATE ROUTE 31

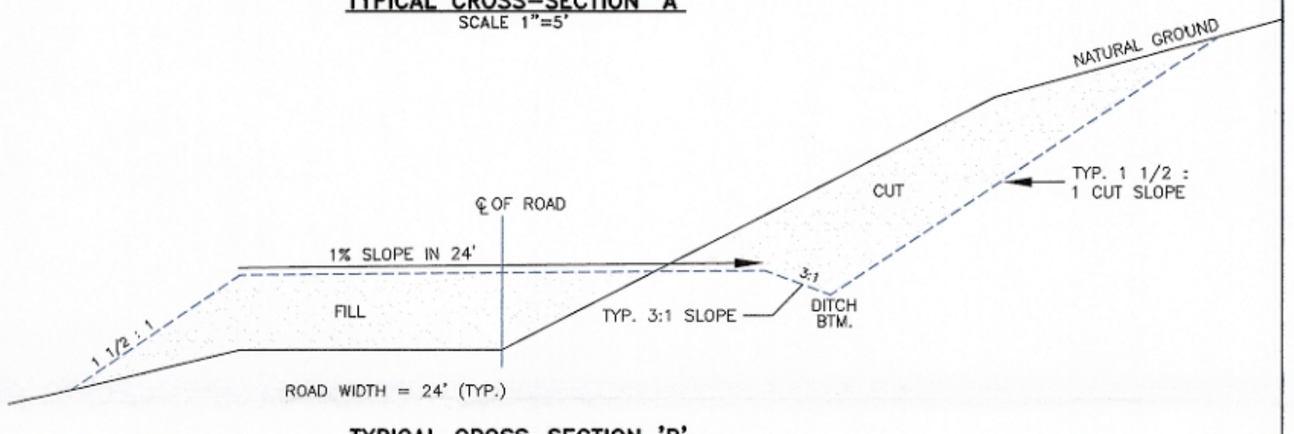
PERMIT AREA BOUNDARY

NOTES:

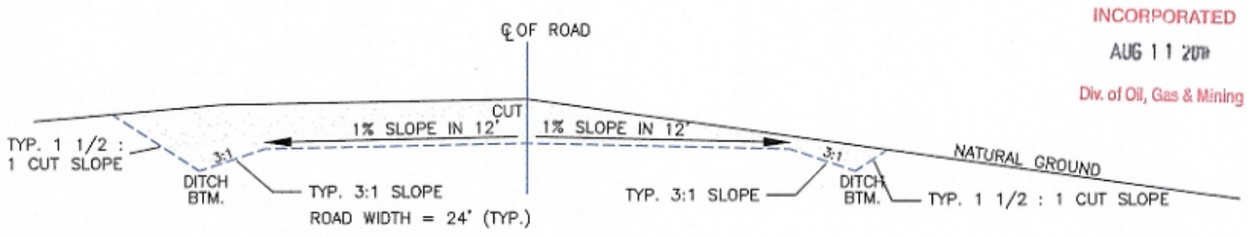
1. TYPICAL DIMENSIONS OF DRAINAGE DITCHES UD-1 THROUGH UD-4 ARE SHOWN ON PLATE 7-2.
2. TYPICAL DIMENSIONS OF DRAINAGE DITCHES UD-5 THROUGH UD-7 ARE SHOWN BELOW.
3. INFORMATION REGARDING THE DIMENSIONS OF THE SEDIMENTATION POND IS PROVIDED ON PLATE 7-1.



TYPICAL CROSS-SECTION 'A'
SCALE 1"=5'



TYPICAL CROSS-SECTION 'B'
SCALE 1"=5'



TYPICAL CROSS-SECTION 'C'
SCALE 1"=5'

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No. 168246
RICHARD B. WHITE
22 Aug 2016
STATE OF UTAH

LEGEND

- PRIMARILY FILL (SEE TYPICAL CROSS-SECTION A)
- PRIMARILY CUT AND FILL (SEE TYPICAL CROSS-SECTION B)
- PRIMARILY CUT (SEE TYPICAL CROSS-SECTION C)
- CULVERT
- DITCH
- DISTURBED AREA BOUNDARY

N

0' 100'

REVISION DATE	BY

BRC Wellington, LLC

PERMIT AREA FACILITIES AND TYPICAL ROAD CROSS-SECTIONS

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE: 1"=100' OR AS NOTED
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER PLATE 5-1

I:\1461\05 - Deer Creek waste rock\MAP - Cheen Cajon\DWG\PLATE 5-1.dwg, 8/16/2016 8:18:14 PM

SECTION 31, T. 16 S., R. 8 E., S.L.B. & M. | SECTION 31, T. 16 S., R. 8 E., S.L.B. & M. | SECTION 32, T. 16 S., R. 8 E., S.L.B. & M.

LOT 6 | LOT 7

STATE OF UTAH
2-76-31
603.12 AC. IN
THIS SECTION

U.S.A.
(BLM)

N 89° 59' E 5254.26' | T. 16 S., R. 8 E. / T. 17 S., R. 8 E. | N 89° 57' E 5425.26'

PERMIT AREA

LOT 4 36.42 AC. | LOT 3 | LOT 2 | LOT 1 | LOT 4 43.25 AC. | LOT 3 43.01 AC. | LOT 2 40.72 AC. | LOT 1 40.49 AC. | U.S.A. 1009813

UTAH POWER & LIGHT COMPANY
3-33-1
429.63 AC.

BRC WELLINGTON, LLC
49.05 AC.

U3-33-3 | U3-32-11

EXISTING WASTE ROCK STORAGE AREA

UTAH POWER & LIGHT COMPANY
3-32-1
114.26 AC.

STATE OF UTAH
461.39 AC.

LOT 5 36.48 AC. | LOT 5 42.53 AC. | LOT 6 42.30 AC. | LOT 7 41.51 AC. | LOT 8 41.58 AC.

UTAH STATE HIGHWAY 31

PERMIT AREA

UTAH POWER & LIGHT COMPANY
3-32-4
64.15 AC.

LOT 6 36.52 AC. | LOT 10 43.09 AC. | LOT 9 43.37 AC. | 5376.36'

PACIFICORP
3-33-1
153.1 AC.

LOT 7 36.58 AC. | LOT 11 43.89 AC. | LOT 12 44.17 AC.

754.10' | 374.40' | 258.04'

WILLIAM H. & JANET
MINCHEY, ET AL.
3-32-9
6.92 AC.

EDWARD D.
HARRISON
3-32-6
11.39 AC.

1355.33' | 1355.92' | 837.11' SOUTH

U.S.A.
24.93 AC.
3-32-2

EMERY TELEPHONE
T3-32-7
0.048 AC.

UTAH STATE HIGHWAY 31

S. 81° 40' E.
294.70'

582.5' | 733.55'

ORCHARD IDELIGHTS, LLC
3-32-5
12.78 AC.

EDWARD HARRISON
3-32-3
11.89 AC.

1355.96' | 754.11' | 374.40' | 1419.81'

SECTION 6, T. 17 S., R. 8 E., S.L.B. & M.

5398.80'
SECTION 5, T. 17 S., R. 8 E., S.L.B. & M.

INCORPORATED
AUG 11 2016
Div. of Oil, Gas & Mining

REGISTERED PROFESSIONAL ENGINEER AND LAND SURVEYOR
No. 168246
RICHARD B. WHITE
8-10-16
Project
STATE OF UTAH

NOT TO SCALE

REVISION	
DATE	BY

BRC Wellington, LLC

SURFACE AND SUBSURFACE OWNERSHIP

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE:	1"=400'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER	PLATE 5-2

PERMIT AREA BOUNDARY

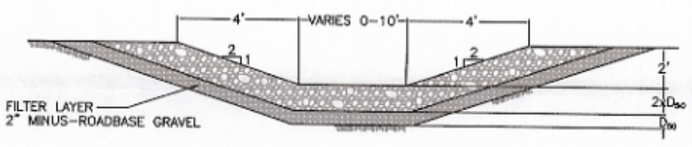
AREA OF FUTURE REJECT PILE (FOCUS OF INITIAL RECLAMATION EFFORTS)

APPROXIMATE BOUNDARY FOR RECLAMATION VOLUME CALCULATIONS, WITH REJECT PILE CALCULATIONS TO THE WEST OF THIS LINE AND ACCESS ROAD CALCULATIONS TO THE SOUTH OF THIS LINE

PERMIT AREA BOUNDARY

PERMIT AREA BOUNDARY

AREA OF CURRENT ACCESS ROAD (TO BE RECLAIMED FROM NORTH TO SOUTH AFTER THE REJECT PILE AREA IS RECLAIMED)



RECLAMATION CHANNEL CROSS SECTION
(SEE TABLE 7-3 FOR INDIVIDUAL CHANNEL WIDTHS)
NTS

INCORPORATED
AUG 11 2016
Div. of Oil, Gas & Mining

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH

LEGEND

- 8140 — EXISTING MAJOR CONTOUR (10 FOOT)
- EXISTING MINOR CONTOUR (2 FOOT)
- 8140 — RECLAMATION MAJOR CONTOUR (10 FOOT)
- RECLAMATION MINOR CONTOUR (2 FOOT)
- DISTURBED AREA BOUNDARY
- RECLAMATION CHANNEL (RC-1 THROUGH RC-11)
- A — A' CROSS SECTION LOCATION (SEE PLATES 5-4 AND 5-5)
- APPROX. BOUNDARY OF PHASE I RECLAMATION GRADING AND REVEGETATION. FINAL RECLAMATION CHANNELS TO BE INSTALLED IN THIS AREA DURING PHASE II RECLAMATION. ALL AREAS OUTSIDE THIS BOUNDARY TO BE RECLAIMED DURING PHASE II RECLAMATION
- TEMPORARY RECLAMATION CHANNEL, TO BE INSTALLED DURING PHASE I RECLAMATION AND REMOVED DURING PHASE II RECLAMATION

0' 100'

REVISION DATE	BY

BRC Wellington, LLC

RECLAMATION PLAN MAP

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE:	1"=100'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER	PLATE 5-3

PERMIT AREA BOUNDARY

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APPROXIMATE BOUNDARY FOR RECLAMATION VOLUME CALCULATIONS, WITH REJECT PILE CALCULATIONS TO THE WEST OF THIS LINE AND ACCESS ROAD CALCULATIONS TO THE SOUTH OF THIS LINE

PERMIT AREA BOUNDARY

PERMIT AREA BOUNDARY

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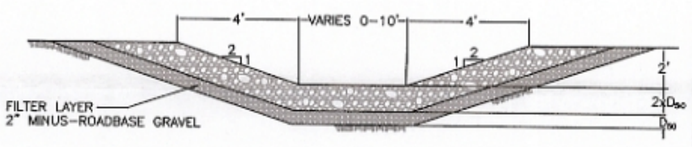

RECLAMATION CHANNEL CROSS SECTION
(SEE TABLE 7-3 FOR INDIVIDUAL CHANNEL WIDTHS)
NTS

INCORPORATED
AUG 11 2016
Div. of Oil, Gas & Mining

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH

LEGEND

- 8140 — EXISTING MAJOR CONTOUR (10 FOOT)
- EXISTING MINOR CONTOUR (2 FOOT)
- 8140 — RECLAMATION MAJOR CONTOUR (10 FOOT)
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- TEMPORARY RECLAMATION CHANNEL, TO BE INSTALLED DURING PHASE I RECLAMATION AND REMOVED DURING PHASE II RECLAMATION

0' 100'

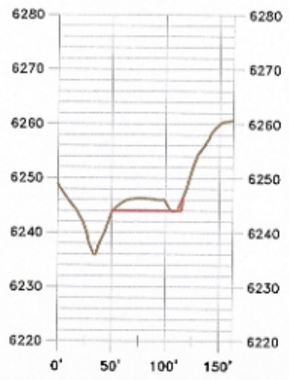
REVISION DATE	BY

BRC Wellington, LLC

RECLAMATION PLAN MAP

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE:	1"=100'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER	PLATE 5-3



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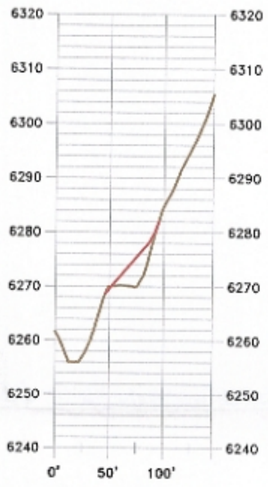

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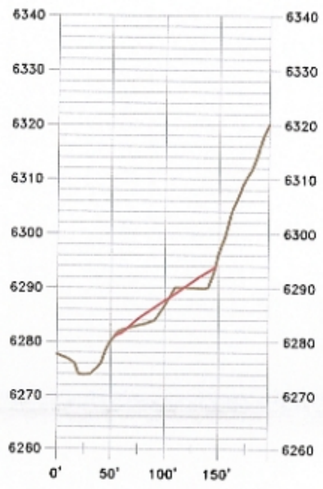

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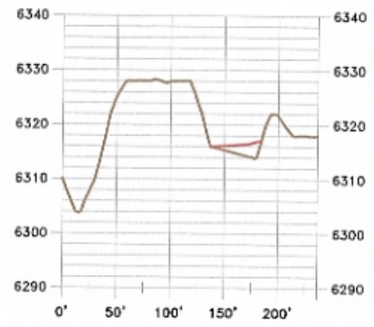

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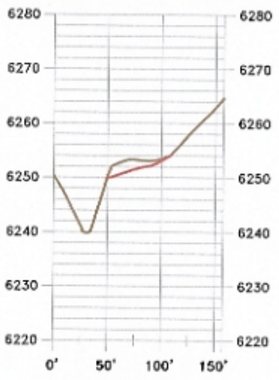

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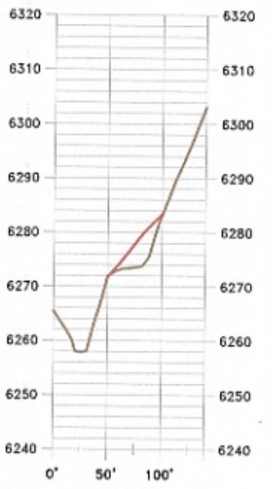

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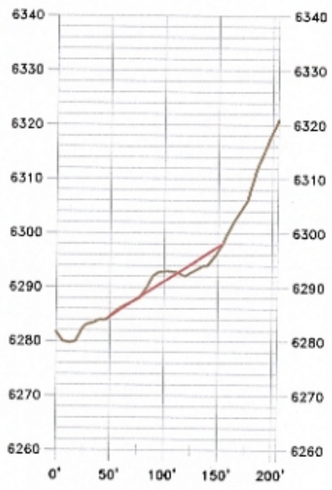

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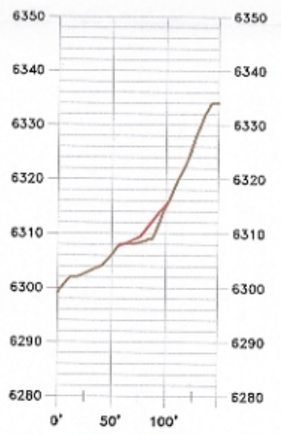
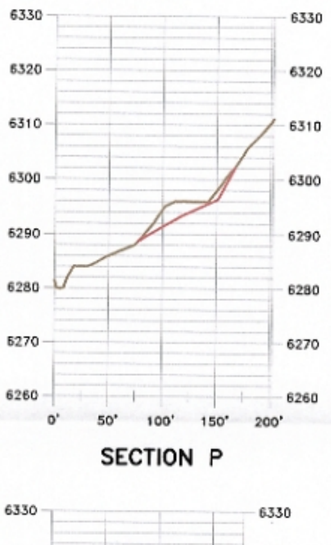


SECTION U

SECTION C



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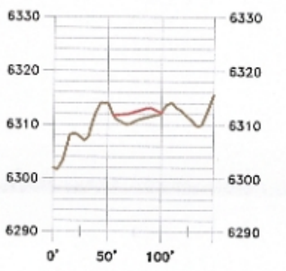
SECTION P



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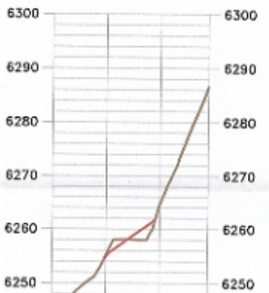

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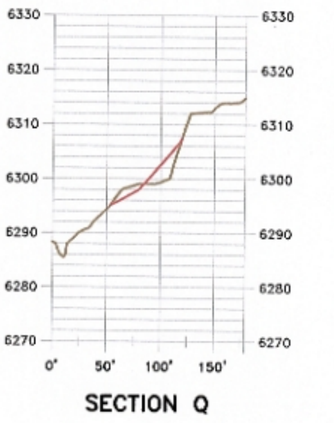

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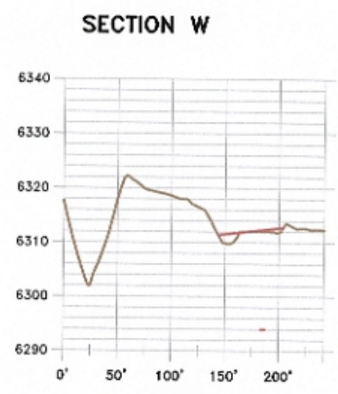

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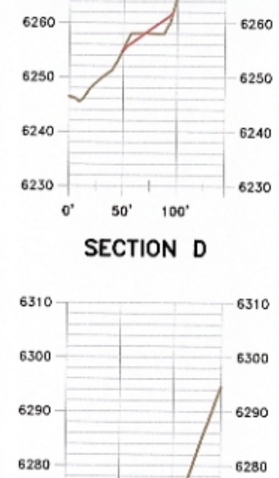

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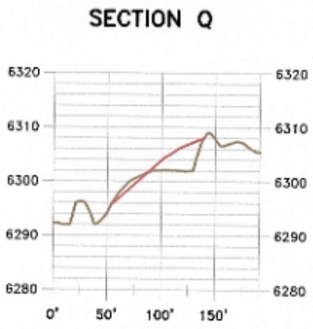

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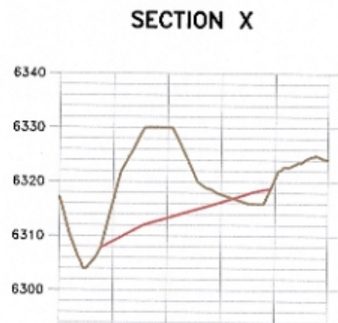

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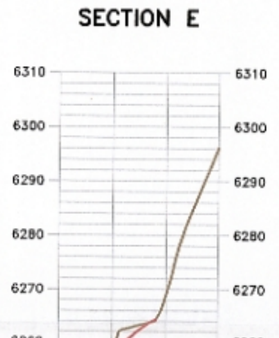

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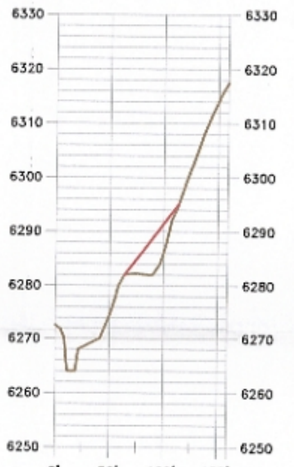

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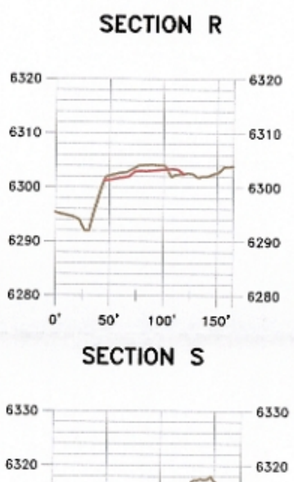

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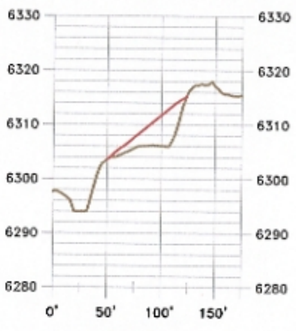

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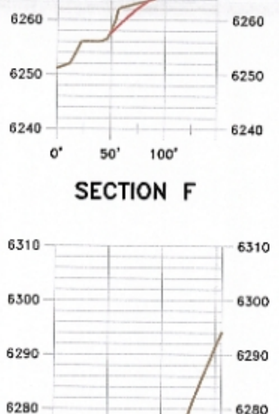

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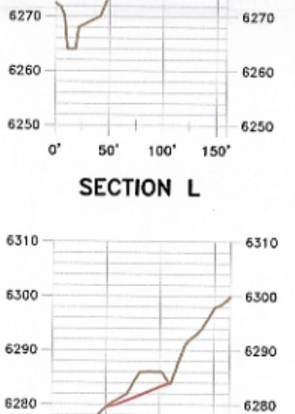


SECTION M

LEGEND

EXISTING GROUND SURFACE

RECLAMATION GROUND SURFACE

INCORPORATED
AUG 11 2016
Div. of Oil, Gas & Mining

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
22 Aug 2016
STATE OF UTAH

HORZ. 1"=100'
VERT. 1"=20'

REVISION DATE	BY

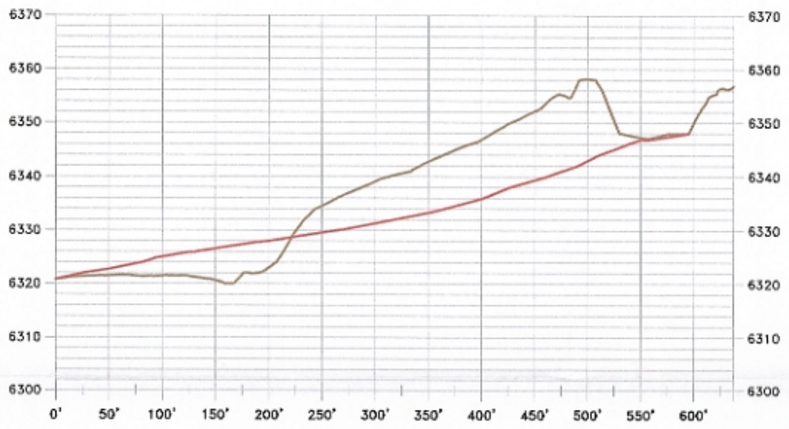
BRC Wellington, LLC

ROAD RECLAMATION CROSS SECTIONS

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE: 1"=100'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER PLATE 5-4

G:\UC1461\05 - Deer Creek waste rock\MAP - Close Out\MXD\PLATE 5-4.dwg, 8/19/2016 8:30:18 PM



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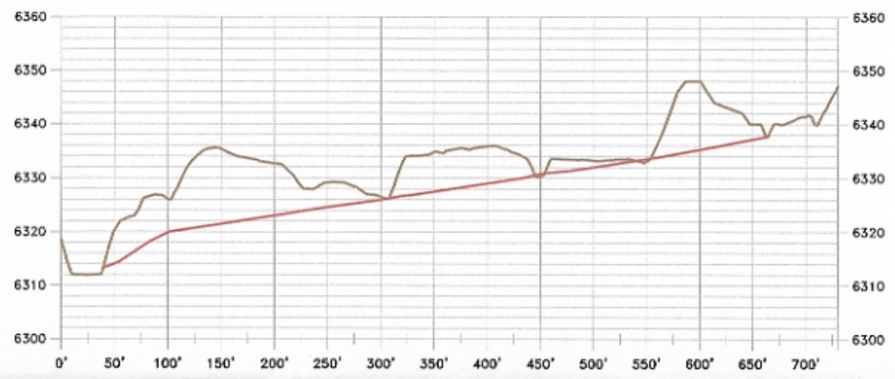

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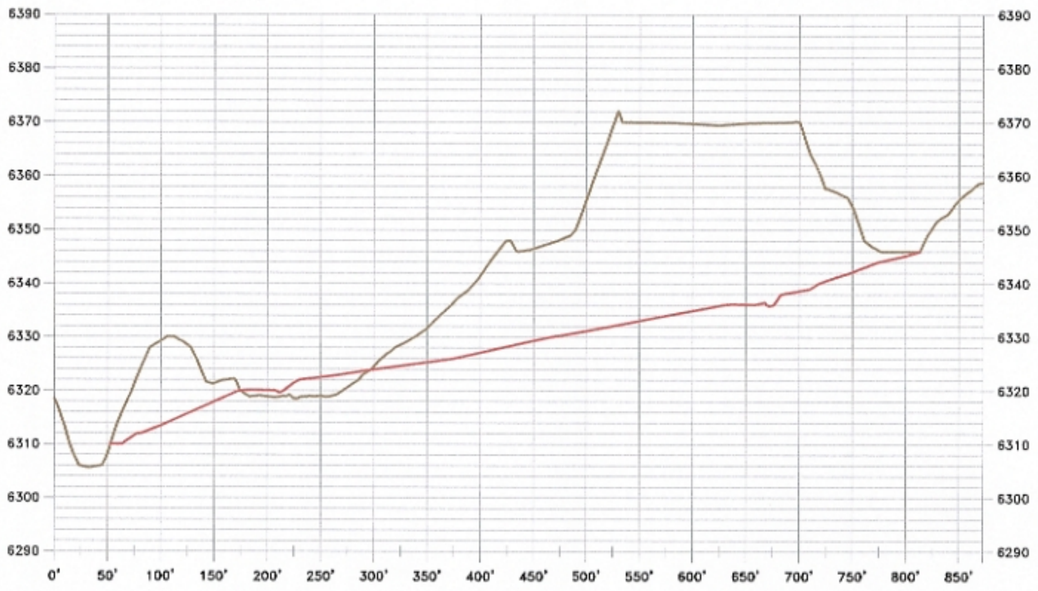

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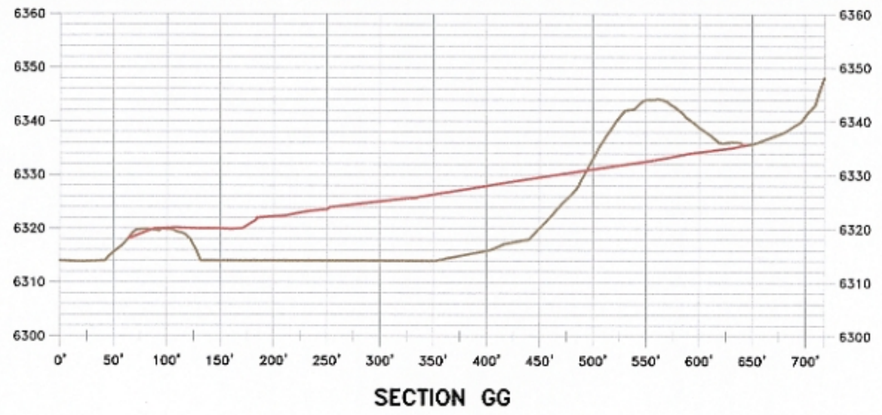

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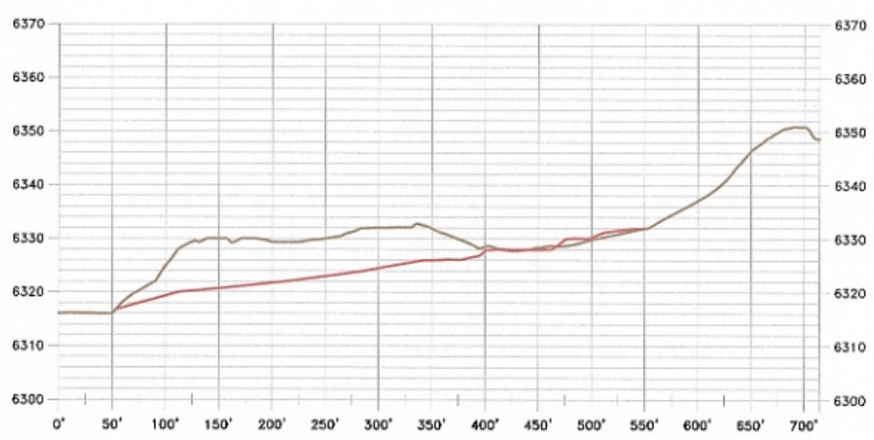

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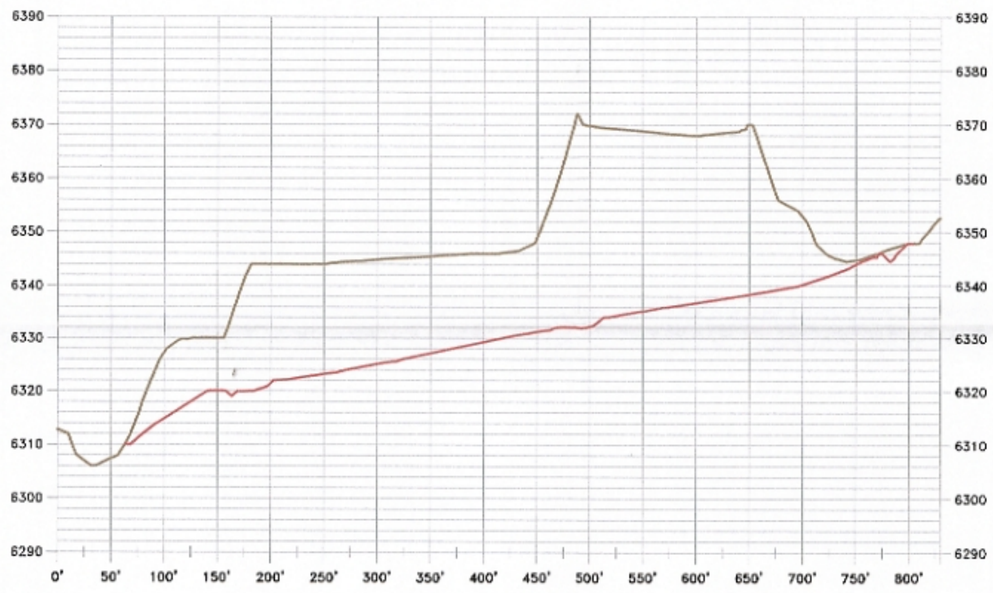

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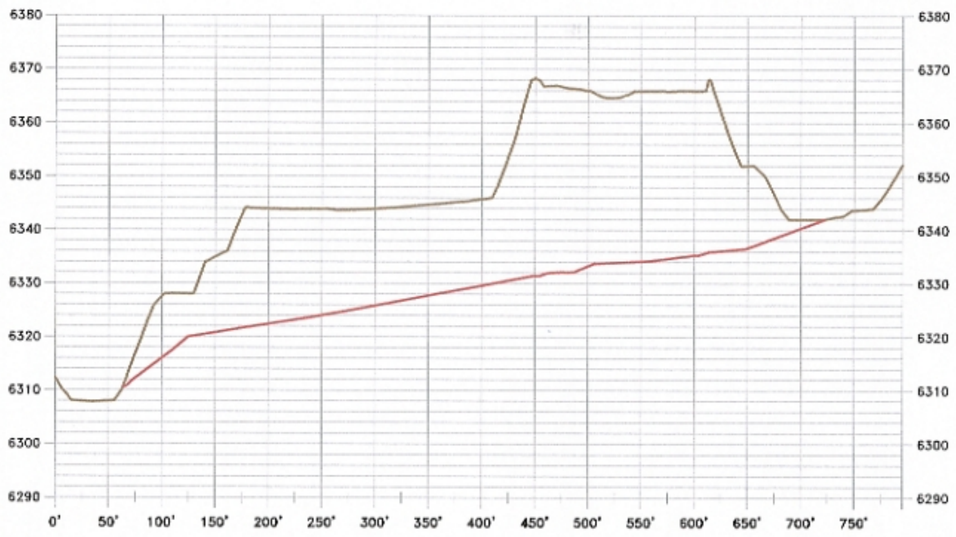

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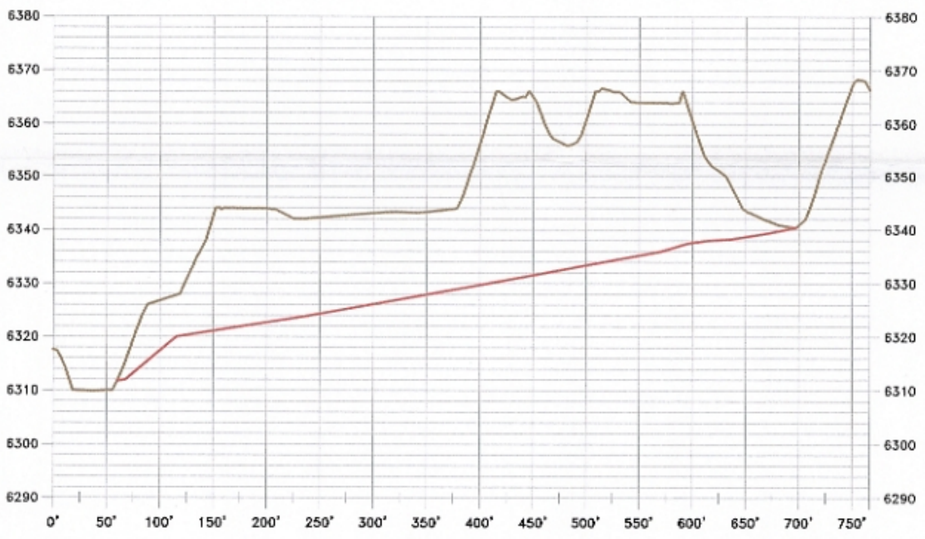


SECTION EE

LEGEND

EXISTING GROUND SURFACE

RECLAMATION GROUND SURFACE

HORZ. 1"=100'
VERT. 1"=20'

INCORPORATED
AUG 11 2016
Div. of Oil, Gas & Mining

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
VALID WITHOUT A SIGNATURE
STATE OF UTAH

REVISION DATE	REVISION BY

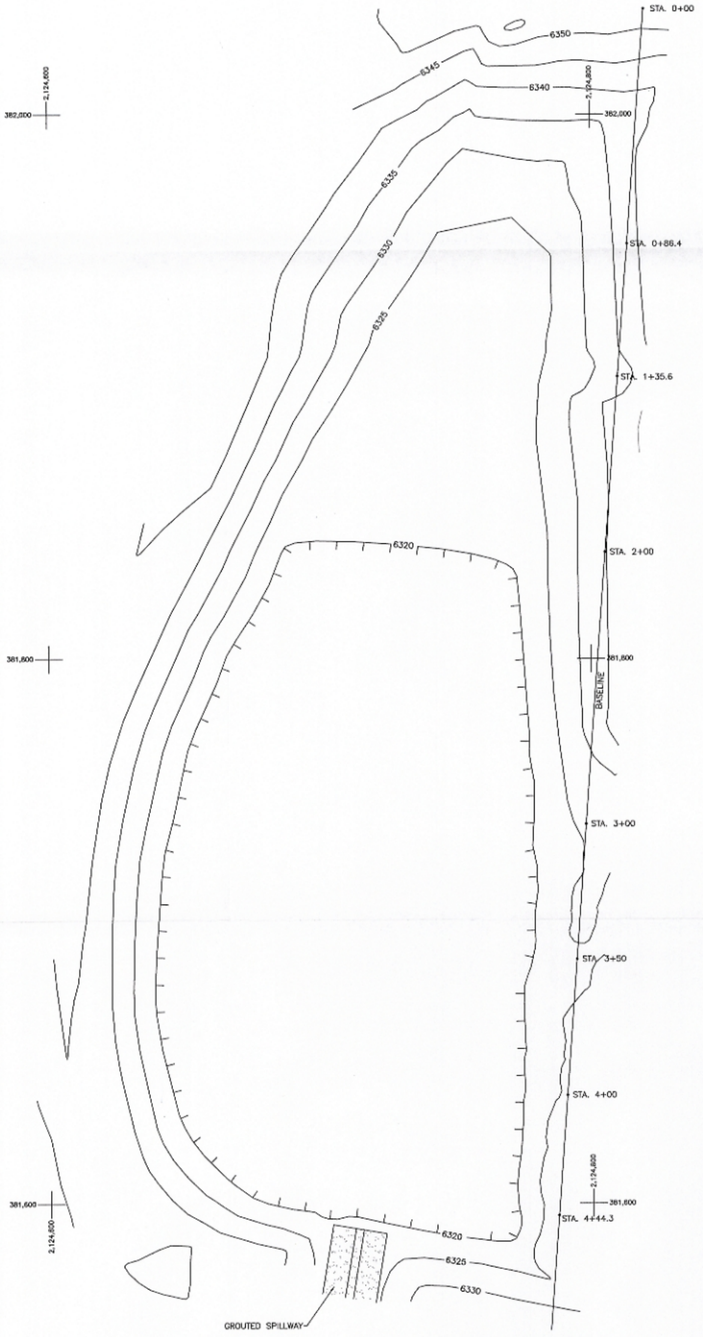
BRC Wellington, LLC

PILE RECLAMATION CROSS SECTIONS

DEER CREEK WASTE ROCK SITE

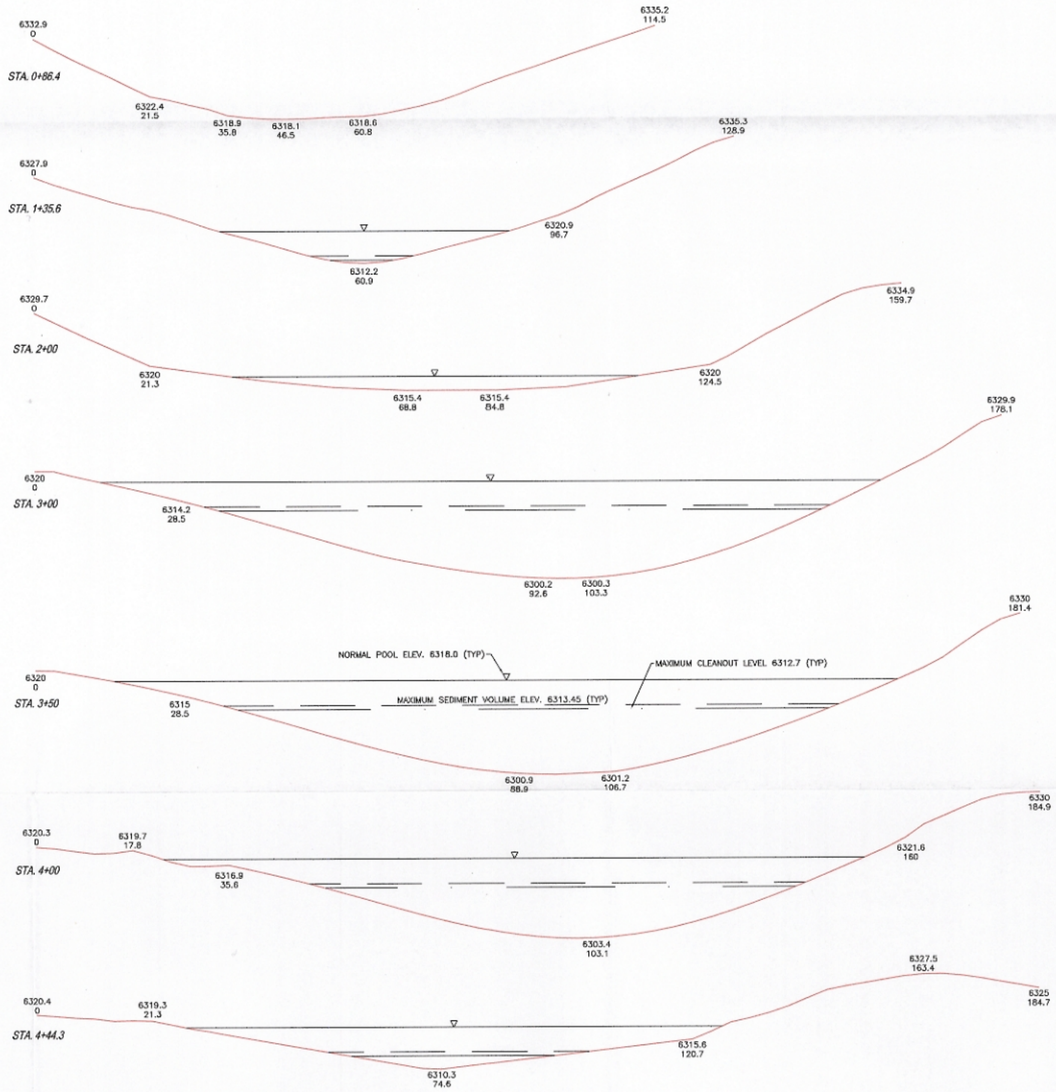
DRAWN BY: KHB	DATE: AUG 2016	SCALE:	HORZ: 1"=100' VERT: 1"=20'
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER	PLATE 5-5

G:\UC1461\05 - Deer Creek waste rock\MAP - Plates Figures\DWG\PLATE 5 Sections 8/19/2016 8:36:13 PM

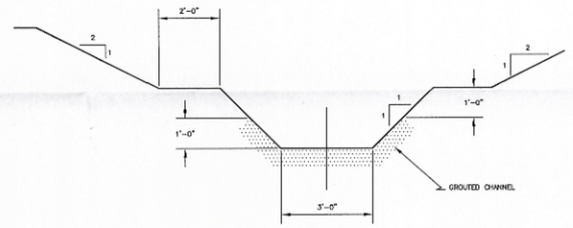


PLAN VIEW - SEDIMENTATION POND
SCALE: 1"=20'

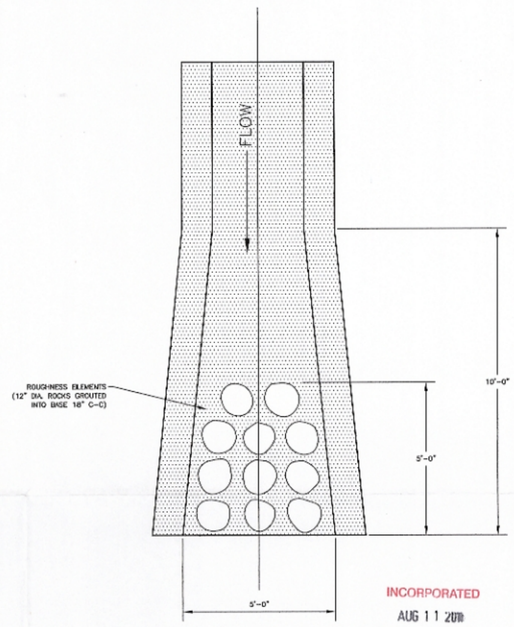
NORMAL POOL ELEVATION 6318.0 (3.66 ACRE FEET STORM WATER STORAGE ABOVE MAX. SEDIMENT STORAGE)
MAXIMUM SEDIMENT VOLUME ELEVATION 6313.45
SEDIMENT CLEANOUT LEVEL 6312.7 (60% OF MAXIMUM)
COMPLETED CONSTRUCTION LINE (AS-BUILT SURVEY SEP 2006)



SEDIMENT POND - CROSS SECTIONS
SCALE: 1"=10'



CROSS SECTION



SPILLWAY DETAILS
SEDIMENT POND DP-1

INCORPORATED
AUG 11 2016
Div. of Oil, Gas & Mining

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH

REVISION	
DATE	BY

BRC Wellington, LLC

SEDIMENTATION POND PLAN AND CROSS SECTIONS

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE: AS NOTED	
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER	PLATE 7-1

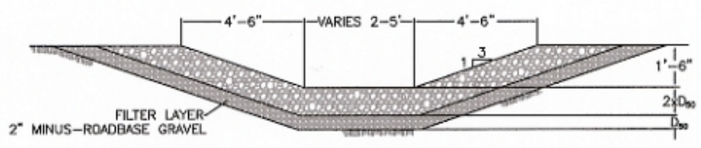
© UC1461\05 - Deer Creek waste rock\GIS\... - Deer Creek\Plate\Pl_7-1.mxd - Date: 8/19/2016 9:10:29 PM

PERMIT AREA BOUNDARY
ASCA 1
UD-3
UD-2
NORTH SOIL STOCKPILE
EXISTING WASTE ROCK PILES (APPROX. 306,700 CY TOTAL)
TEMPORARY PILE ACCESS ROADWAY
4" WET WEATHER SEEP DRAIN PIPE
SEDIMENT POND MAX. WATER LEVEL 6382.0
UD-4
UD-1
SOUTH SOIL STOCKPILE
EXISTING DRAINAGE CHANNEL
ASCA 1
UC-6 (18" ø CULVERT)
UC-1 (18" ø CULVERT)
PERMIT AREA BOUNDARY
UC-2 (18" ø CULVERT)
ASCA 2
UD-5
UC-3 (18" ø CULVERT)
UD-6
UC-4 (18" ø CULVERT)
UD-7
UC-5 (18" ø CULVERT)
ASCA 2
STATE HIGHWAY ROUTE 31
PERMIT AREA BOUNDARY

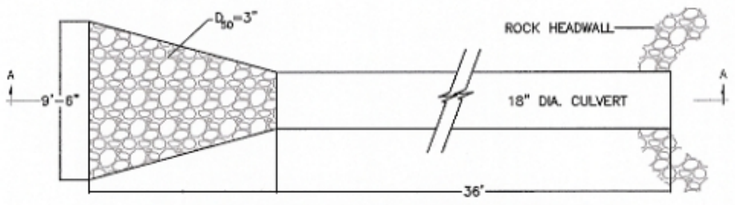
TYPICAL UNDISTURBED TRAPEZOIDAL DRAINAGE DITCH DIMENSIONS

DITCH	BOTTOM WIDTH (FT)	SIDE SLOPES	RIPRAP D_{50} (IN)
UD-1	2	3:1	3.5
UD-2	3	3:1	7
UD-3	4	3:1	7
UD-4	5	3:1	14

UD-5 THRU UD-7: SEE PLATE 5-1.

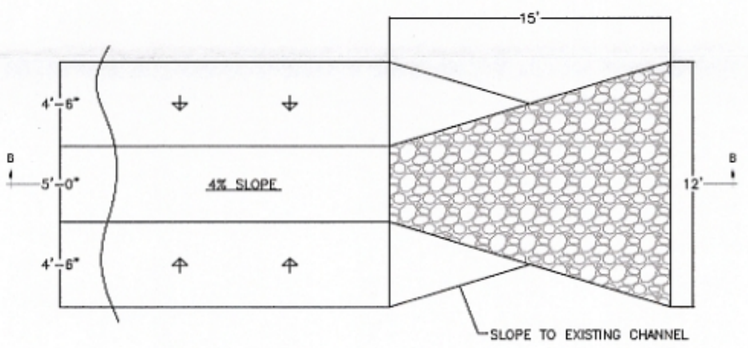


TYPICAL - DITCH CROSS SECTION
SCALE: 1" = 4'



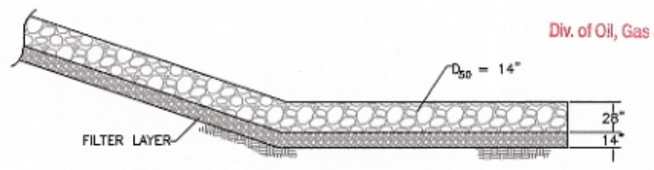
ROCK APRON AT CULVERT DISCHARGE
NTS

SECTION A-A
NTS



ROCK APRON AT DOWNSTREAM END OF UD-4
NTS

INCORPORATED
AUG 11 2016
Div. of Oil, Gas & Mining



SECTION B-B
NTS

LEGEND
ASCA 1 - AREA ADJACENT TO WASTE ROCK PILE
ASCA 2 - AREA ADJACENT TO ROAD
CULVERT
DITCH

REGISTERED PROFESSIONAL ENGINEER
No. 166246
RICHARD B. WHITE
22 May 2016
STATE OF UTAH

0' 100'

REVISION DATE	BY

BRC Wellington, LLC

SITE DRAINAGE MAP

DEER CREEK WASTE ROCK SITE

DRAWN BY: KHB	DATE: AUG 2016	SCALE: 1"=100' OR AS NOTED
APPROVED BY: RBW	PROJ NUMBER: UC1461\05	DRAWING OR MAP NUMBER PLATE 7-2